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INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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COUNTRY USSR

REPORT

SUBJECT Operating Manuals of the Soviet IL-18 Aircraft

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REFERENCES

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THIS IS UNEVALUATED INFORMATION.

1. The document "IL-18 Airliner with Four AI-20 Turboprop Engines - Pilot's Flight Operating Instructions", contains the following information:

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- (a) All principal dimensions.
- (b) AI-20 Turboprop basic data.
- (c) Operating limitations.
- (d) Preflight instructions.
- (e) Engine starting procedures and ground check procedures.
- (f) Flight procedures and limitations.
- (g) Flights in adverse weather.
- (h) Some inflight emergency procedures.
- (i) Operating aircraft systems in flight.
- (j) Installed radio equipment.

2. The document "Maintenance Manual for IL-18 Aircraft - Airframe and Power Plants", contains:

- (a) Preflight procedures.
- (b) Post flight procedures.
- (c) 50,100 and engine change operations.
- (d) Scheduled airframe inspection data.

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3. The document "Maintenance Manual for IL-18 Aircraft - Equipment", contains:

- (a) Equipment preflight and post flight procedures.
- (b) Electrical equipment inspection and maintenance.
- (c) Radio equipment inspection and maintenance.
- (d) Instrument equipment inspection and maintenance.
- (e) K2 - 75 Barograph.

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MAINTENANCE MANUAL

for

~~M-18~~ AIRCRAFT

Airframe and Power Plants

96-AAI

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GENERAL

This Maintenance Manual has been developed on the basis of practical operation of Mi-24 aircraft and is the main document specifying the maintenance of these aircraft.

The Manual contains the description of obligatory operations, the accomplishment of which improves the reliability of the aircraft units operation, provides for operational readiness of the aircraft, prevents a premature wear of the main assemblies.

When performing the periodic maintenance operations, consult the procedures and methods given in the Operation Instructions for the aircraft and equipment, as well as in the Technical Orders.

The Manual contains the following types of the aircraft maintenance:

1. Pre-flight maintenance.
2. Maintenance during a short-time parking.
3. After-flight maintenance.
4. Periodic maintenance after every 50,100 flying hours and when replacing the engines.

The above mentioned types of maintenance must be carried out in the following cases:

1. Pre-flight maintenance is performed directly prior to flight, if on the previous day there was carried out an after-flight maintenance or periodic maintenance operations, as well as before a flight, if the aircraft has been delayed at the airport for more than five hours after being subjected to the pre-flight maintenance or maintenance during a short time parking.

NOTE: If the aircraft is intended for take-off immediately after performing the after-flight or periodic maintenance operations, as well as in case of the aircraft delay at the airport for not more than five hours after being subjected to the pre-flight maintenance or maintenance during a short-time parking, only test the engines on the ground and perform final operations of the pre-flight maintenance directly prior to flight.

2. Maintenance during a short-time parking is performed after every landing of the aircraft at the airports, if the aircraft must not be subjected to more complicated maintenance.

NOTE: When performing training flights, service the aircraft during a short-time parking when performing regular filling-in of the aircraft with fuel and oil, but not less than after every 2-3 flying hours.

3. After-flight maintenance is performed at the base and terminal airports after 20 ± 5 flying hours since the last after-flight or periodic maintenance operations.

4. Periodic maintenance of the aircraft is performed at the base airports after every 50^{+10}_{-5} and 100^{+10}_{-5} flying hours and when replacing the engines due to their service life expiration.

- NOTES:
1. When performing the periodic maintenance operations check the flying or operating hours of the separate instruments and units which have a limited service life, to decide whether or not they must be replaced.
 2. When performing the training flights, service the L.C. and flaps taking into account the number of landings performed: after every 25 ± 5 landings perform 50-hours' periodic maintenance operations; after every 50 ± 5 landings perform 100-hours' periodic

maintenance operations; after every 100+10 landings perform the periodic maintenance operations as specified when replacing the engines.

After every rough landing or rolling onto the soil thoroughly inspect the aircraft and power plants and make sure that the aircraft skin is not deformed, that the airframe structure, power plants, L.G. and flight controls are not damaged and that the fuel and oil do not leak. When accomplishing every type of maintenance, perform the operations given for the corresponding type of maintenance and remedy the defects detected during a flight or inspection of the aircraft.

Perform all the types of maintenance using the necessary ground equipment, mechanization and tools. The aircraft maintenance must be performed by the specially trained technical personnel being familiar with the aircraft structure and equipment and the special features of the Mi-18 aircraft operation.

- WARNING:
1. Walk on the aircraft skin only in special soft footwear with special covers put on it. When walking on the wing and tail unit step only between the spars.
 2. Never rest ladders and other ground equipment, which is not padded with soft stuff against the aircraft skin (especially against the fuselage pressurized section skin).

PRE-FLIGHT MAINTENANCE

PRELIMINARY OPERATIONS

1. Check, whether fire-fighting equipment is available near the aircraft, the wheel chocks are placed around the wheels of the main L.G. and the aircraft is grounded.
2. Remove the covers and shields from the aircraft and power plants.

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3. In winter remove snow, ice and hoar-frost from the aircraft surfaces, propellers, windows of the cockpit and passenger cabins, vent pipes, air intakes, hinge fittings of the rudder, elevator and ailerons as well as from the L.G. bogies, shock struts and locks.

4. At an ambient air temperature below -5°C heat the engines and the oil cooler. Prevent hot air from getting into the thermoelement blast pipes.

5. Make sure that: all the electric power consumers are "off", engine power control levers are set in the "Ground idle" position, the L.G. buttons on the central control pedestal are not depressed and the "L.G. retract" button is protected with a safety cap and locked with a pin, the wheel anti-skid control switch is locked in the "Anti-skid ON" position, emergency braking release switch is "OFF" and locked, the L.G. emergency release control lever is pushed fully down and locked, the control switches for the cabin pressurizing system shutters are "OFF".

POWER PLANTS

1. Inspect the propeller blades, heating elements, fairings detachable parts attachment and make sure that they are free from external damages.

2. Check the engine cowlings for leakage traces of fuel, oil and fluid:

3. Inspect the engine cowlings and nacelles for external damages. Check the cowl latches and nacelle access doors for locking.

4. Check the engine rotor for free rotation by turning the propeller by hand 3-4 revolutions in the direction of rotation and make sure that there is no foreign noise in the engine.

5. Inspect the engine air intake duct for foreign objects.
6. Check the tanks for being filled with required quantity of fuel and refuel them, if necessary. Drain 0.5 to 1 litre of fuel sediment through the drain points of tanks Nos. 1, 3 and 9 and check the sediment for presence of water, mechanical particles and ice crystals.
7. Prepare the engines for starting. Start the engines and test them on the ground in accordance with the Engine operation and maintenance instructions.

WARNING: Before starting the engine, remove all the foreign objects fore and aft of the aircraft and clean the area in front of the aircraft.

8. On testing the engines on the ground:
 - a) Inspect the engine cowlings for leaks of oil, fuel and hydraulic fluid. Open the side cowl panels and inspection doors. Check the pipe connections and units for condition and the engine power control levers and rods for security of connection.
 - b) Using a bayonet gauge check the oil quantity in the tanks and replenish the tanks up to 12 litres if necessary. Close the side cowl panels and inspection doors.
 - c) Check the propeller blades for condition.

AIRFRAME

1. Inspect the skin of the fuselage, wing, stabilizer, fin, ailerons, rudder and elevator and flaps. Inspect also the cargo doors, fillets, emergency exits and cabin windows and, make sure that they are free from external damages. Check the locks of the doors, access doors, small windows and cockpit canopy for

proper operation; check the fuselage access doors and wing inspection doors for closing.

2. Check the areas of the fuel tanks, units and pipelines location for fuel leakage and the wing integral fuel tank rivets for missing.

3. Check that all the switches, valves and units are in the initial position.

4. Inspect the nose L.G. and main L.G. tyres for local bulging and external damages. Check the tyres inflation pressure by their reduction. The tyres reduction at the maximum take-off weight should be:

for nose L.G. - 25 to 35 mm.

for main L.G. - 65 to 75 mm.

5. In the L.G. wells inspect the units, pipelines, hoses and connections of the hydraulic, nitrogen and fuel systems. Make sure that there are no leaks and external damages. Make sure that the filter drain cock is closed and locked.

WARNING: 1. Before working in the L.G. wells open the L.G. doors and install safety devices on the L.G. door control cylinders rods.

2. At an outside air temperature below -30°C never open the L.G. doors by operating the hydraulic system (by pressing TA-163 valve manual control buttons), if more than three hours have passed since the last recharging of the hydraulic accumulators.

6. Inspect the nose and main L.G. shock struts, L.G. actuating and wheel steering cylinders, pipe-line swivel joints, make sure that the hydraulic fluid does not leak. Check the L.G. shock struts compression and locking. The shock struts compression when the aircraft is parked should be:

for nose L.G. - 180 to 190 mm.;

for main L.G. - 340 to 380 mm.

7. Inspect the locks of the nose and main L.G.: the "Up" locks should be opened and the "Down" locks should be closed. See that the lock springs and cables are not damaged. Make sure that the lock lever, connecting the spring cylinder of the selector valve rests on the stop and the cylinder spring rod is not bent.

8. Observing the pressure gauges readings make sure that both emergency braking system bottles are charged with nitrogen up to a normal pressure. The pressure in the emergency braking system bottle must be from 130 to 150 kg./cm.² and in the propeller feathering bottles - 60 to 70 kg./cm.². Check the fluid level in the hydraulic reservoir with the hydraulic accumulators charged.

9. Test the brakes for proper functioning at full depression of the brake control pedals the brake pressure should be 65±5 kg./cm.² and the brake system hydraulic accumulator pressure gauge should read not less than 100 kg./cm.².

WARNING: The accumulator of the main hydraulic system and brake system are limited in operation by outside air temperature. At an outside air temperature of -30°C or below blow each L.G. well with hot air for 20 min. before operating the hydraulic system or starting the engines (but not less than 30 min. before).

10. Check the aircraft control surfaces lock system for operation; check its warning system.

11. Unlock the ailerons, rudder and elevator and check them for proper operation. Check the trim tabs for deflection up to the maximum angles and check their warning system with the trim tabs in neutral position.

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12. Check the flaps for proper operation. Operating the M13-9 electric actuator extend and retract the flaps. Should the electric actuator slip, adjust the limit switches.

TOILET ROOMS AND WATER SUPPLY SYSTEM

1. Check the toilet rooms equipment for cleanliness and serviceability. Check the toilet room for presence of soap and paper napkins.

2. Fill the water tanks with water and the toilet waste tanks with chemical liquid.

NOTE: At an outside air temperature below $+5^{\circ}\text{C}$ fill the tanks with water and chemical liquid after heating the aircraft cabin and toilet rooms.

3. Check the warm and cold water supply to the wash stand tubs; check the chemical liquid supply to sluice the closets.

FINAL OPERATIONS

1. Deliver the aircraft to the crew and tow it to the airport.

2. At an outside air temperature below $+5^{\circ}\text{C}$ heat the aircraft cabins up to $+15^{\circ}\text{C}$ prior to passengers' embarkment, and at an outside air temperature above $+25^{\circ}\text{C}$ cool the cabin air using a ground air conditioner.

3. When loading the aircraft prevent its skin from being damaged with cargoes or ground equipment devices.

4. Close all the aircraft doors and access doors. Remove pins from the L.C. locks. Retract the aircraft grounding cable.

5. Tow the aircraft to the preliminary flight line and place chocks around the main L.C. wheels.
6. Prepare the engines for starting. After starting the engines disconnect an external power source from the aircraft electric system and remove the chocks from the L.C. wheels.
7. Watch how the engines run and see how the aircraft taxis out to the flight line.

MAINTENANCE DURING A SHORT-TIME PARKING

1. Receive the aircraft at the parking area.
2. After stopping the engines make sure that the aircraft grounding cable is released. Open the access doors to afford access to the L.C. down locks and install the pins in the L.C. down locks. Place the chocks around the main L.C. wheels.
3. At an outside air temperature above +25°C during the whole parking period cool the aircraft cabins from the ground air conditioner, and at an outside air temperature below +5°C heat the cabins maintaining the temperature not below +15°C.
4. Lock the ailerons, rudder and elevator.
5. Obtain necessary information from the crew as to the aircraft operation in flight.
6. Refuel the aircraft. Drain 0.5 to 1 litre of fuel sediment through the drain cocks of tanks Nos. 1, 2 and 9. Lock the cocks.
7. Drain the fuel from the fuel collector tanks through the bottom cowl panel access doors, preventing the fuel from getting onto the cowl panels.
8. Check the engine cowl panels the skin of the fuselage, wing, wing centre section, L.C. fairings

and L.G. brake system pipelines for signs of fuel, oil and fluid leakage.

9. Make sure that the chemical liquid and water do not leak from the toilets.

10. Check the engine rotor for free rotation turning the propellers by hand 3 to 4 revolutions in the direction of rotation and make sure that there is no foreign noise in the engine.

Inspect the propellers and spinners. See that the blade heating elements are not damaged. Wipe the propellers with a clean napkin.

11. Inspect the engines air intake ducts.

12. Visually inspect the engine cowlings and nacelles for damages. Check the engine cowl latch for condition.

13. Open the engine side cowl panels. Using a dip stick check the oil tanks for oil quantity and refill the oil tanks, if necessary, up to 32 litres.

Inspect the accessories, pipelines and electric wiring. Check the engine power control levers and rods for security of connection. Close the side cowl panels.

14. Inspect the L.G. shock struts, drag and brace struts, bogies, wheel steering cylinders and tyre-line swivel joints for damages and hydraulic fluid leakage. Make sure that the lockings are safe. Check the shock struts compression and the tyres inflating according to their reduction. The shock strut compression when the aircraft is parked should be:

for nose L.G. - 180 to 190 mm.;

for main L.G. - 360 to 400 mm..

The tyre reduction at the maximum take-off weight should be:

for nose L.G. wheels - 25 to 35 mm;

for main L.G. wheels - 65 to 75 mm.

15. Inspect the cabins and toilet rooms. If necessary carry out cleaning, drain sewage, wash the filter, fill the closet waste tanks with chemical liquid and the water tanks with water.

16. Visually inspect the skin of the fuselage, wing centre section, wing outer panels, ailerons, flaps and tail unit for external damages. Check that the vent pipes of the fuel and oil systems are not clogged or frozen.

If necessary, clean off dirt and oil spots from the aircraft skin engine nacelles and L.G. fairings.

17. Inspect the entrance doors, cargo doors and their locks. Make sure that the cabin windows are not damaged.

FINAL OPERATIONS

1. Unlock the rudder, elevator and ailerons. Remove the pins from the L.G. locks.
2. On starting the engines disconnect the external power source from the aircraft electric system.
3. Remove the chocks from the L.G. wheels.
4. Watch how the engines run and how the aircraft taxis out to the flight line.

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AFTER-FLIGHT MAINTENANCE, MAINTENANCE AFTER 50, 100 FLYING HOURS AND WHEN REPLACING THE ENGINES.

Nos.	Description of operations	Types of maintenance			
		A ²⁾	50	100	When replacing engines
<u>PRELIMINARY OPERATIONS</u>					
1.	Receive the aircraft at the parking area. After stopping the engines install the L.G. locks pins and place the chocks around the main L.G. wheels. <u>NOTE:</u> At an outside air temperature below -20°C reduce pressure in the "Main line" hydraulic accumulator to zero using the L.G. door control valve, but do it not later than in 30-45 minutes after stopping the engines.	x	x	x	x
2.	Install shields on the engine air intakes and put covers on the Pitot tubes. <u>NOTE:</u> Install the jet pipes shield only in 5-10 minutes after stopping the engines.	x	x	x	x
3.	Obtain necessary information from the crew members as to the aircraft operation in flight and accept the aircraft.				

1) Marked with "x" are operations to be performed.

2) A - After flight maintenance.

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Nos.	Description of operations	Types of maintenance			
		4	50	100	Interim change
4.	Make sure that all the electric power consumers are off, the engine power control levers are set in the "Ground idle" position, the L.C. valves control button is protected with the safety cap, the flap control lever is set in the "Retracted" position, the wing and the tail unit de-icing system control switches are off, the fire extinguishing system manual control switches are in the neutral position and locked. The fuel shut-off valves are closed. Look the rudder, elevator and ailerons. After the wheel brake mechanisms are checked, apply the parking brake and make sure that the brake system pressure is of 42 to 66 kg./cm. ² Make sure that the engine cowl panels, vent pipes, fuselage and wing skin, L.C. fairings and brake system pipelines are free from fuel, oil or water leakage. Drain the fuel from the power plant fuel collector tanks. Drain the water from the water supply system and filling pipelines, as well as the sewage from the closet waste tanks. Wash the filters and waste tanks with warm water. On draining the sewage wipe the drain panel and the fuselage skin near the panel first with moistened and then with dry rags.	x	x	x	x
5.		x	x	x	x
6.		x	x	x	x
7.		x	x	x	x

Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	<u>NOTE:</u> At an outside air temperature below zero perform the above mentioned operation immediately after stopping the engines (before the cabins are cooled), drain also the water from the air conditioning system humidifier tank with the filler neck opened.				
8.	Perform the engines internal preservation.	-	-	-	x
	<u>NOTE:</u> Before washing the engine oil filters make sure that the oil system is free from metal particles.				
9.	Wipe the propellers and engines with a napkin slightly moistened with gasoline.	x	x	x	x
10.	Clean and wash the L.C., the aircraft skin, clean the cabins and toilet rooms.	x	x	x	x
	POWER PLANT				
1.	Inspect the propeller blades and heating elements for damages. Check the propeller spinner for condition and security of locking of its detachable parts. Make sure that there is no oil leakage from the flange connection of the propeller to the engine reduction gear shaft.				

Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
2.	Check the propeller-to-engine reduction gear shaft attachment, blades-to-propeller hub attachment, propeller spinner brackets attachment.	-	x	x	-
3 ^x)	Check the propeller blades beating at the trailing edge of the points marked with reference lines. Permissible blade beating is not more than 3 mm. Check the beating with the blades set at zero setting angle.	-	-	x	x
4 ^x)	Check the propeller blades clamps attachment and locking for condition.	-	-	x	x
5.	Inspect the engine air intake duct and make sure that the intake guide vanes are free from dents and the intake duct skin is not damaged.				
6.	Check the engine rotor for free rotation turning the propeller by hand 3 to 5 revolutions in the direction of rotation and make sure that the engine is free from foreign noise.	x	x	x	-
7.	Open the engine cowl panels and inspect them. Check the cowl panel latches for reliability and the rubber sealing strips for conditions. Inspect the front cowl ring and the bottom cowl panel (on the inboard engine). Make sure that the front cowl ring, cowl beam and bottom cowl panel are securely attached.	x	x	x	x
x) When replacing the engines perform operations Nos. 3 and 4 after installing the propeller.					

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Nos.	Description of operations	Types of maintenance			
		A	60	100	Engine change
8.	Inspect the engine and the combustion chamber casing in the places of welding the fuel nozzles attachment flanges. Make sure that the accessories are securely attached to the engine. Check the rear journals-to-compressor casing attachment. Inspect the oil and fuel main pipelines, vent pipes, de-icing and fire extinguishing systems pipelines. Make sure that they are free from damages, and tightly connected. Check the pipelines and bonding strips for security of attachment.	x	x	x	
9.	Inspect the oil tank, oil cooler, shutter control actuator and feathering pump for cracks, dents, wearing, loose attachment and oil leakage. Check the bonding strips and locking for damages. Check adjustment of the oil cooler duct shutter closed position. Using a dip stick check the oil contents in the oil tank and replenish the tank with oil, if necessary.				
10.	Check the engine power control levers and rods for secure connection.	x	x	x	
11. x)	Inspect the engine mount assemblies, supporting struts and beams for cracks, wearing, deformation and proper locking. Check the condition of the engine mount front and rear shock struts and make sure that they	x	x	x	x
x)	When replacing the engine perform operations No. 11 and No. 12 after removing the engine from the aircraft.				

Hds.	Description of operations	Types of maintenance
	are in good condition.	50 100
12. x)	Inspect the engine nacelle load-bearing structure, brackets, attachment	
13. x)	Inspect the jet pipe (without removing the rear section panel) for cracks, burning and deformation. Check the jet pipe attachment.	
14.	Check the engine oil level.	
15.	Remove the engine front panel and inspect for metal particles and other debris. Clean the panel and install them in place. Check the panel seals and rubber sealings.	
16. x)	Remove the oil and fuel filters and inspect the filters for clogging and debris. Clean the filters with kerosene and install them in place. Check the filter seals and inspect the rubber sealings.	
17.	When replacing the engine perform operation 15 and 16 after removing the engine from aircraft.	
18. x)	When replacing the engine perform operation 15 and 16 after removing the nacelle rear section panel.	
19. x)	To avoid the cases of damage to the ball-type safety valves and check the fuel filters of the KTA fuel control unit every 25 ± 5 engine hours.	

Nos.	Description of operations	Type of maintenance	16	180	100
<u>WARNING:</u>	Remove and install the filters in compression. To prevent damage or installing the air filter, clean the fuel line and valve rods.				
17.	Remove the KTA power control system deceleration snubbers. Inspect the snubbers for clogging and damage. Wash the snubbers with clean kerosene and install in place. Before installing the snubbers install the sealing rings. <u>WARNING:</u> The snubbers are not interchangeable. Always install them in their proper places.				
18.	Drain oil from the thermo-corrector of the fuel control unit through the drain plug.	-	x	x	-
19.	Remove the oil filters of the compressor and turbine bearings, inspect the filters for metal particles. Wash the filters with clean kerosene and install them in place. Before installing the filters inspect the sealings.	-	x	x	-
20.	Remove the aircraft fuel filters, inspect them for clogging and damages. Wash the filters with clean kerosene and install them in place. Before installing the filters inspect the rubber sealings.	-	x	x	x
	<u>WARNING:</u> Install the filters in places according to their marking.				

Nos.	Description of operations	Types of maintenance			
		1	50	100	Engine change
21.	Remove the oil filter of P-68 constant speed governor, inspect it for metal particles and dirt. Wash the filter with clean kerosene and install it in place.			X	-
22.	Test the propeller emergency feathering nitrogen system for tightness. Test the nitrogen system tightness at a pressure in the aircraft bottle of 60 to 70 kg/cm ² .			X	X
23.	Check the engine power control adjustment. Renew the adjustment at the engine control rod connections. Check the JHT-2 power control lever position indicator for synchronous readings with those of the KTA fuel control unit dial. The difference between the readings of the KTA fuel control unit dial and those of JHT-2 indicator should be within 1 mm.			X	-
24.	Check the propeller emergency feathering system with pneumatic engine stop for reliable operation.			X	-
NOTE: In case of a premature replacing of the engine KTA fuel control unit or JHT-2, recheck the adjustment after 100 hours of operation.					
this check.					
25.	Prepare the engine for starting. Start and test the engine on the ground according to the "A-20" engine instruction and maintenance instructions.				

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No..

Description of operations

With the inboard engines running, partially releasing the pressure from the hydraulic system make sure that the HL-25/5 hydraulic pumps and PA-I2IM-3 pump relief valves reliably operate. Observing the readings of the pressure gauges on the instrument panel make sure that after 2 or 3 initial rechargings, the pressure in the "Main system" and brake system hydraulic accumulators remains stable or only a slight pressure drop is observed.

- NOTES:
1. At an outside air temperature of -5°C or below, heat the engine and the oil cooler. When heating, prevent hot air from getting into the thermo-element blast tube.
 2. In case of draining the oil from the engine, oil tank and oil cooler before starting the engine it is necessary: a) to fill the oil tank with oil (at an outside air temperature below zero heat the oil before filling up to $70-80^{\circ}\text{C}$); b) perform cold rotation of the engine; c) replenish the oil tank with oil.

3. Remove the engine whose service life is expired.

Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
AIRFRAME AND PLANS					
1.	Inspect the fuselage nose cap skin for cracks, dents and deformation. Check the nose cap locks for proper functioning.	x	x	x	x
2.	Inspect the cockpit glazing for cracks, scratches and "silvering" of the window panels. Check the window panels for security of attachment, the joints for tightness and the small windows sealing rubber strips for condition.	x	x	x	x
3.	Inspect the fuselage skin, riveted and bolt joints for cracks, deep dents, scratches, deformation, loose rivets and bolts and damage to lacquer coatings. Inspect the battery compartments for freedom from corrosion. Inspect the passenger cabin window panels for cracks, scratches and "silvering".	x	x	x	x
4.	Check the condition of the skin and edging of the entrance doors, emergency exits, toilet and ground air conditioning system access doors. Be sure that the skin edges and edgings are free from cracks. Check the doors sealing rubber strips (except emergency exits) for condition. Check the condition of the freight holding bins, door and access door locks. Be sure that no leakage is in the toilet room and pantry areas.				x

Des.

Description of operations

5. Inspect the skin of the stabiliser, fin, elevator, rudder, balanced tab and trim tabs for cracks, deep dents, deformation, loose rivets and bolts and for damage to lacquer coatings. Visually inspect the devices' outer surfaces for condition. Inspect the static dischargers for condition and presence of brushes.
6. See that no leakage traces are present in the areas of the fuel tanks and fuel system units locations. Inspect the pressure fuelling control panels. Examine the lockings and bonding strips for condition.
7. Inspect the skin of the wing centre section, wing outer panels, ailerons and fillets for cracks, deep dents, deformation and burning of the wing L.B. surface; loose rivets and bolts and for damage to lacquer coatings. Check the panels, wing L.B. for security of attachment and the access doors and locks for condition and functioning. Inspect the static dischargers for condition and presence of brushes. Inspect the fuel system vent outlets.
8. Test the pilots' seats mechanism for proper operation and for security of their locking in all positions. Inspect the door panels in the cockpit and front toilet room for damage.

Nos.	Description of operations				
	Test the toilet and front wardrobe mechanisms for proper functioning.				
9.	Examine the inner skin of the passenger cabin and the seats for damage and dirt. Check the seats for reliable attachment and the adjusting mechanisms for proper operation.				
10.	Examine the floor panels of the passenger cabin, galley, front wardrobe toilet rooms for damage. Check the equipment for condition.	x	x	x	x
11.	Examine the drain holes for clogging and accumulation of moisture, snow and ice in the wing centre section, wing outer panels, fuselage tail section, flaps and ailerons. Examine the fuselage tail section and cooling turbine installation area for corrosion.	x	x	x	x
12.	Extend the flaps, wipe the tracks, brackets and the flap control screws. Examine the brackets, fittings, carriages and ballbearings for cracks and loose bolts. Examine the tracks for scores and the carriages for wearing. Check the skin of the flaps, collectors and cover strap for cracks, deformation, loose rivets and bolts. Check the bonding strips for proper condition.	x	x	x	x
13.	Check the condition of the flap control screw attachment fittings, joints and the screws attachment to the wing. Cover the screws with the coating of <u>UNATHAN-201</u> lubricant.				

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Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
14.	Examine all the places of the fuselage pressurized section having damages, mentioned in the chart furnished with the Aircraft Log Book.	x	x	x	x
15.	Check the flaps operation by one or two electric motors. By the extension and retraction time be sure that the electric motors operate reliably without slipping. The flaps extension and retraction time should be: by two electric motors - not more than 14 sec.; by one electric motor - not more than 28 sec.	x	x	x	x
16.	Coat with transformer oil all the movable joints of the entrance doors and cargo doors locks (without disassembling the locks).	-	x	x	x
17.	Examine the dehydrators of the passenger cabin and cockpit canopy window panel. With the oilseal colour changed, replace the dehydrators. When installing new dehydrators make sure that they are installed airtight. Remove the water traps and drain water accumulated in them.	-	x	x	x
18.	Through the inspection doors in the baggage compartment check whether water is accumulated in the underfloor space. In case of presence of water open the floor panels and dry the inspection.	-	-	x	x
19.	Extend and retract the flaps by a mechanical drive and be sure that the crank rotates smoothly without sharp changes in loads and the system is	-	-	-	-

Nos.	Description of operations	Types of maintenance
		100 hours engine overhaul
	free from sticking, creaks and knocks.	
20.	Tighten the bolts on the wing outer panels-to-centre section lower joints on the lower detachable panels of the wing centre section and wing outer panels, on the load-carrying inspection doors and also on the wing L.E.-to-spar, fillets-to-wing and fuselage attachment places.	
	<u>NOTE:</u> Perform the above operations also after the first 50 flying hours.	
21.	Tighten the outer wing upper panels-to-centre section attachment bolts with a torque of 380 to 420 kg.-cm. After checking the bolts tightening cover them with a thick coating of EMAPM-201 lubricant.	
	<u>NOTE:</u> Perform this operation also after the first 50 flying hours.	
22.	Check the stabilizer and fin-to-fuselage attachment fittings for condition and loose bolt joints.	
23.	Check the condition of the rubber edgings on the wing centre section L.E.-to-fuselage joints, engine nacelles and the wing centre section P.M. skin.	
24.	Remove the wing centre section upper fillets and examine the fuselage attachment fittings, the skin of the wing centre section and fuselage	

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DESCRIPTION OF OPERATIONS

under the fillets, rivets and bolts on the wing, engine nacelle and
fillets discharges for erosion, deformation, loose rivets, etc.

Check the condition of the rubber seals on the engine.

25. Check all the four emergency exit doors for proper operation of the rubber sealing strips.

26. Remove the entrance doors carriages which hold the doors open. Lubricate with **OMATM-201** lubricant and install as shown.

27. Thoroughly examine the fuselage skin, the skin lap joints and riveted joints in the area of frames Nos. 31-35, including the riveted and bolted joints on the outer skin between frames Nos. 29 and 31 from stationer No. 9 down from the wing centre section and also the skin on the flange of the propeller discs.

28. Examine the cargo loading points, end frames (Nos. 24, 34, 36), protection of the aircraft control rods and the baggage compartments structural elements for cracks, deformation and damages.

29. After every 400 flying hours remove the flaps and the carriages bearing attachment bolts. Wash the flaps hinges and control system elements with kerosene.

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Nos.	Description of operations	Time of performance	No.	No.	No.	No.
AIRCRAFT AND ENGINE CONTROLS						
1.	Examine the control wheel, control column and control pedals for damages.		x	x	x	x
2.	Check the control surfaces for proper operations: a) by moving the control column forward make sure that it easily (without sharp change in force) deflects through a full angle; with the control column moved backward, it easily deflects 2/3 of its travel and then at the end of the travel the force increases to 45 kg. b) by operating the pedals, be sure that they easily move half of the travel (≈ 60 mm.) and then, with the restricting sector spring engaged, the forces considerably increase and at the end of the travel are equal to 160 kg.; c) by operating the ailerons, check them for absence of plays and sticking; d) with the elevator controls locked, check the control wheel for absence of play.		x	x	x	x

If, with a 5-6 kg. force applied to the control column, the control wheel axis has a 10-20 mm. play (knock is heard) it means that the

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Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	Duplicating control parts operate and the main system failed. In this case on no account permit the flight.				
3.	Check the deflection and neutral position of the elevator and rudder. Set the trim tabs in neutral position and check the warning lights for proper operation; make sure that the trim tab controls are free from sticking and plays.	x	x	x	x
4.	Test the elevator and rudder locks as follows: a) be sure that with the ABC-10 circuit breakers on the navigator's switch panel off the aircraft control surfaces cannot be locked by means of the 2NH-45 selector switches; b) set both the 2NH-45 selector switches in the "Locked" position and make sure that the control surfaces are locked; the red lights on the light panel No.6 should come on; c) set both the selector switches in the "Unlocked" position. The red lights on the light panel No.6 should go out. The control column and pedals should freely move, providing the elevator and rudder full deflection up to the stops. Switch off the ABC-10 circuit breakers on the navigator's switch panel.	x	x	x	x

Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
5.	Examine the ailerons, elevator, rudder, trim tabs and spring balance tab hinge joints and hinge brackets. Check them for freedom from plays.	-	x	x	x
6.	Open the removable floor panels of the passenger cabin and the cockpit and open the fuselage tail section access door. Examine the cables, pulleys, fair leads, bellcranks, fittings, balance weight, stop and pressure seals having removed dirt and dust from them. Check the pulleys for free rotation, be sure that the clearances between the pulleys and rods are within 0.1-0.2 mm. Check to see that the cables are properly run over the pulleys. Check the locking and bonding status for cable ties. Wipe the cables with a clean cloth. Coat the pressure seals of the rods and cables with LUBRICANT-201 lubricant.	-	x	x	x
7.	Fill each pressure seal with 50 cm ² of AMI-10 fluid and check the pressure seals for no leakage.	-	x	x	x
8.	Check the engine controls and the engine power control levers travel. If necessary, adjust the cables.	-	x	x	x
9.	Open the access doors of the wing centre section and outer panels. Examine the aircraft and flaps control system elements: rods, fairleads, universal joints and trim tab, control mechanism.	-	x	x	x

Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	Examine the flaps universal joints for wear. Coat the universal joints with EMALUM-201 lubricant. In case of wear in the universal joints, disassemble the universal joints and remedy the defect.				
10.	Coat the hinge joints of the ailerons, rudder, elevator, trim tabs, spring balance tab, rudder restricting sector spring cylinder with EMALUM-201 lubricant.	-	-	x	x
11.	Remove the control columns covers, examine the chains, gears and cables for condition. Coat the chains and gears with EMALUM-201 lubricant and install the covers in place. After every 500 flying hours, besides periodic maintenance, proceed as follows:	-	-	x	x
	1. Remove the control column cover, disconnect the cables and fully pull out the chains with adapting parts. Remove the old lubricant from the chains and sprockets, examine them from serviceability. Coat the chains with EMALUM-201 lubricant and install them in place.				
	2. Check the cable tension in accordance with the table given below:				

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Description of controls	Cable effort, kg.	Cable tension, kg.
Ailerons control	4	40-5
Ailerons control	3	40-5
Elevator and rudder servo units control	3	40-5
Trim tabs control	2-3	40-5
Nose wheel steering	2.5	40-5

3. Check the friction force values in the ailerons, elevator, rudder and trim tabs control systems. The friction force should not exceed the following values:

- when moving the control wheel forward and backward - 4 kg.
- when moving the control wheel forward - 3 kg.
- when rotating the control wheel in either direction - 4-5 kg.

The force required for rotating the elevator trim tab control wheel should not exceed 3 kg. for the full travel and 4 kg., when the shuttle passes the neutral position.

NOTE: If the friction force exceeds the above value find the cause and remedy it. It is also permitted to replace the control system bearings.

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Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	LANDING GEAR AND L.G. LOCKS CONTROL SYSTEM				
1x)	Inspect the wheel tyres. The tyres with the following defects are followed for operation:	x	x	x	x
	- aging traces on tyre surface;				
	- punctures in tyre tread till the second layer of fabric.				
	The tyres worn to the first layer of fabric must be replaced. Inspect the wheels for cracks and dents. See to be sure that the wheel tension nuts locking is not damaged.				
2.	Using a pressure gauge check the tyre pressure.	x	x	x	x
	The pressure must be within the following limits:				
	- 6 ± 0.2 kg./cm ² for nose L.G. wheels;				
	- 8 ± 0.2 kg./cm ² for main L.G. wheels.				
3.	Observing the indicator scale check the shock struts compression.	x	x	x	x
	The compression must be within the following limits:				
	- 180 to 190 mm. for nose L.G.				
	- 240 to 260 mm. for main L.G.				

x) After replacing the engines, operation No.1 is performed after removing the L.G. wheels.

Nos.	Description of operations	Types of maintenance			
		A	30	100	Engine
	If the shock struts compression exceeds the above values test the shock struts for nitrogen charging and fluid filling. The shock strut piston travel when filling and checking the fluid level should be as follows: - 207 $\pm$ 1 mm. for nose L.G. - 417 $\pm$ 1 mm. for main L.G.				
4.	Open the L.G. doors and inspect them for damages to their inner and outer skins. Pay particular attention to the door inner skin where could be damages caused by the wheel tyres when extending the landing gear. WARNING 1. Before working on L.G. valves, open the L.G. doors and mount safety devices on the door warning system. When outside air temperature below -30°C, never open the L.G. doors by operating the hydraulic system (by pressing Emergency valves manual control buttons) if the latest charging of the hydraulic accumulators took place more than 3 hours before.	X	X	X	X
5.	Inspect the attachment fittings of the L.G. fulcrum, up and down locks, strut link and cylinder for cracks, deformation, loose rivets and bolts on the fittings and lower panel.	X	X	X	X

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Nos.	Description of operations	Types of maintenance			
		A	SO	100	1000
6.	Inspect the L.G. bogies, dampers, shock struts, fulcrums, links, welded joints, L.G. actuating cylinders and wheel steering cylinders, L.G. locks, brace struts, torque scissors, universal joints, landing sections, cables and pulleys, pipe swivel couplings and hoses for cracks, dents, deformation, wearing and fluid leakage. Ensure that the nose L.G. position mechanical indicator for proper functioning. Examine the condition of locking. See to be sure that the bogie groundwing cables are in good condition.	x	x	x	x
7.	Wipe the exposed surfaces of the hydraulic cylinders rods and shock strut Rams. Clean dirt away from the L.G. locks.	x	x	x	x
8.	Check that the L.G. lock control handle is in the extreme control handle position in the spring clip.				
<u>NOTE:</u> If, in flight, the emergency extension of the L.G. was performed, jack the aircraft and check the L.G. locks control adjustment, selector valves position, fluid level in the hydraulic reservoir, hydraulic system tightness and functioning of PA-121N/3 pump relief units, hydraulic accumulators and PA-142/2 and PA-163 valves. After testing the hydraulic system, extend retract the L.G. two or three times.					

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Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
9.	Inspect the L.C. locks and doors control cables and pulleys and nose wheel steering control cables. Check the cables for correct running over the pulleys and for proper locking. Wipe the cables with rags dampened in ATF-1 fluid and then with a clean napkin.	-	x	x	x
10.	Replenish REAMM-201 lubricant in joints and on friction surfaces of the L.C. fulcrum journals, joints of the brace struts, L.C. actuating cylinders, dampers, bogie axles, rocker arms, hook shafts and lock latches, brake levers, torque scissors, links leading members, bearings of the nose L.C. steering collar and L.C. door hinges. Fill the L.C. zerks with REAMM-201 lubricant.	-	x	x	x
11.	Inspect the pressure seals of the L.C. locks control cables. If the rubber inserts are damaged or cause the cable sticking replace the defective pressure seal.	-	-	x	x
12.	Test the L.C. up locks for opening. Pull the L.C. locks emergency opening control lever fully and check clearances between the lock latches and hook ends. These clearances for the nose L.C. should be not less than 13 mm. and 20 mm. for the main L.C.	-	-	x	x

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Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	<u>NOTE:</u> After measuring the clearances, lower the lever in recess and check that the L.C. up locks springs return the cables to the initial position and the selector valves levers rest on stops.				
13.	When fluid starts flowing from the main L.C. lock control cylinder to the main L.C. door control cylinders, check that the clearances between the hook noses and bushings on the main L.C. door control cylinders pins are not less than 8 mm. When checking clearances, place an insert 26 mm. high between the rocking stop of the cylinder rod, door lock and cable control lever.	-	-	x	x
14.	Jack the aircraft, Remove the main L.C. wheels. Wash the wheel axles and parts. Clean dirt off from brake mechanisms and blow them with compressed air. Inspect the axles, brake mechanisms and wheel parts for proper condition and functioning. Ensure that the wheel drum hubs are free from cracks. Grease the wheel bearings with HK-50 lubricant and brake anti-skid system gears with <u>LIPTON-201</u> lubricant. Mount the wheels in place and lock tension nuts. When installing the wheels see that felt oil seals are properly seated in their grooves. When installing the oil seals use a special guide bush.	-	-	x	x

Nos.	Description of operations	Type of maintenance	A	B	C	D
	<u>NOTE:</u> Tighten the wheel bearings till the wheel resists to rotate. It indicates that the bearing clearances are removed. Then loosen the tension nut 1/6 revolution and lock the nut. The nut locking must prevent altering of the bearing tension.					
15.	Remove the nose L.S. wheels. Wash the wheel axle and parts and check them for condition. Grease the wheel bearings with MX-70 lubricant and install them in place. Safety the wheel tension nuts. <u>NOTE:</u> Tighten the wheel bearings till the wheel resists to rotate. It indicates that the bearing clearances are removed. Then loosen the tension nut 1/6 revolution and lock the nut. The nut locking must prevent altering of the bearing tension.					
16.	Check the axial play of the brake lever with a drive on the wheel axle. The axial play must be within 0.3 to 0.7 mm.					
17.	Check the free travel of the nose L.S. steering control wheel. Permissible free travel, indicated by the pointer on the control wheel, should not exceed 5 deg. in either direction.					
18.	Connect a ground hydraulic test rig to the aircraft and check: - L.S. retraction and extension from the main hydraulic system not less					

No.	Description of operations	Types of maintenance	A	B	C	D	E
	than three times. Note the time required for L.G. retraction and extension (retraction time must not exceed 20 sec. extension time - not more than 15 sec.); - the bogie turning when retracting the L.G. - operation of the main L.G. down lock latches; - clearances between the L.G. lock latches and check the springs condition; - emergency extension of the L.G. by operating the emergency control lever. At that, measure the lever force required to open the latch. The lever force must not exceed 30 kg.; - clearances between wheel tyres and spring assemblies. The clearances must be as follows: a) between a tyre and inner slip of the L.G. door (when closed) - not less than 20 mm.; b) between a tyre and the pin on the right L.G. door control mechanism - not less than 7 mm.;						

23.

Inspection of components

Install pins on the L.F. lower shear and remove the pins from the lower shear.

24.

Measure the distance between the L.F. lower shear and the L.F. upper shear.

- a) at a distance of 100 mm.
- b) at a distance of 150 mm.
- c) at a distance of 200 mm.
- d) at a distance of 250 mm.
- e) at a distance of 300 mm.

25.

After every 100 hours of operation, perform the scheduled maintenance:

1. Check clearance between the L.F. shear struts.
2. Thoroughly inspect the main L.F. torque scissors, pay particular attention to wearing of the end surfaces of the central torque link intermediate washer.

It is not permitted to remove clearances between the washer and eyes by tightening the central bolt nut. To eliminate these clearances, replace the intermediate washer.

one that all the valves, with exception of the L.G. door control cylinders, are in their initial positions.

WARNING:

1. Before working in the L.G. well, open the L.G. door and place safety devices on the L.G. door control cylinders rods.
2. At an outside air temperature of -30°C or below, never open the L.G. door by operating the hydraulic system (by pressing LA-163 valves manual control buttons) if the latest recharging of the hydraulic accumulators was performed more than three hours before.
3. At an outside air temperature of -30°C or below, before operating the hydraulic system or before starting the inboard engines (not earlier than 15-20 min. before) blow each L.G. well with hot air during 20 minutes.
4. At an outside air temperature of -20°C or below, after testing the inboard engines or the hydraulic system from a ground hydraulic test rig, reduce the "Main

Sec.

Description of operations

Type of maintenance
150 150 150 150

IA-163 system hydraulic accumulators pressure is held by valve.

2. Reduce the pressure only in 15-20 min. after stopping the engines of the hydraulic test rig. Check the brake operation by observing the pressure gauges readings. With the brake control pedals fully pressed, the pressure in the wheel brakes must be 65 ± 5 kg./cm². When testing the brakes, the pressure in the hydraulic accumulators must be not less than 100 kg./cm².

NOTE: When changing the engines, check the brake pressure by reference gauges comparing their readings with those of the pressure gauges on the instrument panel.

3. Inspect the units, pipelines and hoses of the hydraulic-nitrogen system in the L.C. wheels. Check the lockings and bonding strips for condition. See to be sure that the lock lever, connecting the spring cylinder of the selector valve, rests on the stop and the spring rod is not bent.
4. Charge the emergency braking and prep. feathering systems bottles with nitrogen. The pressure in the emergency braking system bottles should be from 130 to 150 kg./cm² and in the emergency prep. feathering and

Nos.	Description of operations	Type of maintenance
	engine pneumatic stepping bellows - from 50 to 30 psi/sec	
5.	Check the fluid level in the hydraulic reservoir with the hydraulic reservoir accumulators charged and discharged.	
6.	Check the rubber seals on the accumulator after bleed for proper condition.	
7.	Grease the universal joints and the steering knuckle joints.	
8.	Drain sediment from the main and the filter and then filter the oil so that the fluid level is 10-15 mm above the dipstick level.	
9. ^{x)}	Check the fluid level in the hydraulic reservoir accumulators. The fluid level should be 10-15 mm above the dipstick level and. Then checking the fluid level, the wheel brakes must be released.	
	<u>NOTE:</u> Check the fluid level after using the emergency braking system too.	
10.	With the aircraft parked test: - hydraulic system operation when retracting and extending the L.G. and check the warning system operation;	
	^{x)} When replacing the engine, operation No. 9 is performed after washing the filters and filling fluid into the converters.	

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Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	- brake system operation, after performing 8-10 brakings from the main system and 2-3 brakings from the emergency system; - parking brake operation; the pressure should be 13150 kg/cm²; - anti-skid control operation; - nose wheels steering control operation for 2-3 cycles; - windscreen wipers operation during 1-2 min. at various ratings. When checking the glass panels, position them with water or with alcohol at a temperature below zero. 11. Test the LA-124B/3 pump relief valve operation from a ground hydraulic test rig and with the engine running. With the ground hydraulic test rig operating observe the pressure gauge installed in the hydraulic panels and, with the engine running, observe the pressure gauges and warning lights on the engine's instrument panel. 12. Check the number of hydraulic cycles of the accumulators. Number of full brakings from all the hydraulic accumulators must be equal to 16 and from the brake system accumulators - 8. 13. Inspect the hydraulic and nitrogen system units, pipelines and hoses in the wing centre section, front engine compartment, engine compartment.				

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Nos.	Description of operations	Type of Maintenance		
		1	50	100
	and in the cockpit for proper functioning and security of attachment. Check the lockings and bonding strips for condition.			
14.	Remove the filtering elements of the main hydraulic system filters and braking system fine filter. Inspect the elements and wash them in clean kerosene and install in place. Close and lock the filters drain cocks.			
15.	Drain 3-5 litres of fluid from the hydraulic reservoir through a siphon and see that the fluid is clean. If the fluid is dirty, drain the reservoir fully, wash the reservoir and its filter and fill the reservoir with fresh fluid.			

NOTE: If the reservoir fluid was changed due to being dirty, again drain 3-5 litres of fluid from the hydraulic reservoir through a siphon after performing all the work on the hydraulic system and L.S. and see that the fluid is clean. If the fluid continues to dirty after the system check-out, change the fluid to the next grade.

Wash the filter of the hydraulic system and the filter of the braking system separately and fill them with fresh fluid.

No.	Description of maintenance	Types of maintenance	Engine change
		100	X
17.	Drain sediment from the hydraulic system filter and remove the filtering element. Inspect the filtering element, wash it with clean gasoline, blow with air and install in place. Close and lock the drain cock.		X
	<u>NOTE:</u> At a temperature below zero, blow the pump with warm air, drain sediment and wash the filtering element.		
18.	Drain water from the charging and prep. feathering line water traps.		X
	<u>NOTE:</u> At a temperature below zero preliminarily blow the water trap with warm air.		
19.	Check the nitrogen pressure in the hydraulic accumulators. Pressure in the accumulator nitrogen chamber must be from 30 to 63 kg./cm. ²		X
	<u>NOTE:</u> When the aircraft is idle for three months check nitrogen pressure in the hydraulic accumulators.		
20.	Check the internal tightness of the hydraulic and nitrogen systems. Check detecting devices of the units and pipelines from the hydraulic/nitrogen system for tightness after repairing the units or pipelines.		X
21.	After every 500 flying hours change fluid in the hydraulic system.		X

Nos.	Description of operations	Types of maintenance			Engine change
		A	50	100	
CABIN AIR SYSTEM, HEATING AND VENTILATION					
1.	Visually inspect the engine-to-air conditioning system pipes for condition.	x	x	x	x
2.	Check the cooling turbine fan for easy rotation by the hand.	x	x	x	x
3.	Check the cockpit windscreen blast nozzles for proper setting. Each nozzle should be installed parallel to the windscreen plane with a clearance. The nozzle slots along the entire length should be equal within 3-4 mm.	x	x	x	x
4.	Check the cockpit windscreen blast shutter for smooth travel by moving the handle up and down on the right console.	x	x	x	x
5.	Check the cooling turbine for security of attachment.	x	x	x	x
6.	Examine the condition of the air-to-air heat exchanger in accessible places. When replacing the air-to-air heat exchanger, inspect its attachment fittings.	x	x	x	x
7.	Check the pressure limiters for security of attachment.	x	x	x	x
8.	Examine the bracket attaching the pipe installed on frame No. 25 in the heat exchanger compartment for fractures and cracks.	x	x	x	x
9.	Fill the cooling turbine with oil and tighten the plug.	x	x	x	x

Index	Description of operations	Range of performance	Engine change
		50 100	
10.	Examine the pressure differential between the fuselage and the wing sections through the pipeline connection. The pressure differential should be zero. If a pressure differential is detected, replace the sealing ring.	X	X
11.	Through the access door, examine the interior of the wing section for signs of air leakage to the atmosphere. The air exchanger for cracks and leakage.	X	X
12.	Inspect the non-return valve of the air return line. The valve should easily return from the open to the closed position.	X	X
13.	Visually inspect the temperature compensators installed outside the fuselage pressurized section and in the wing centre section. The compensators, corrugations should be free from distortion and should contact one another.	X	X

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Nos.	Description of operations	Types of maintenance			
		A	50	100	Engine change
14.	Check all the pipelines, 469 H pressure regulator, 435 E safety valve and 307A 2000000 for security of attachment.	-	-	x	x
15.	Check the insulation condition and attachment of the pipelines in the fuselage pressurized section.	-	-	-	x
16.	Check the condition of the heat insulation and soundproofing in the cabin underfloor space through the inspection doors in the floor panels: if moisture is detected on the heat and soundproofing insulation, take out the floor panels, remove water and dry the heat and soundproofing insulation and the fuselage skin with hot air at a temperature of 80 to 100°C.	-	-	-	x
17.	Check the kinematic linkage and correct actuation of all the throttles (two shutters, at air inlet to the system installed on the air-to-air heat exchanger, two mixing shutters installed on frames Nos.4 and 34, by-pass shutters assembly installed under the wing centre section at the "Pressurization unit access door" operating them by the corresponding selector switches from the cabin. The shutters should turn from the open to the closed position and vice versa freely without sticking. Axial plays in control rods are not permitted.	-	-	-	-

Operation of operations

Type of maintenance
A 10 100 engine
change

After every 100 flying hours, besides periodic maintenance, do as follows:

1. Check the cabin pressurization according to the Operation Instructions and enter the check data in the prescribed cabin certificate.

CAUTION: Check the cabin pressurization also when replacing window panels or sealing strips.

2. Check the cabin pressurization system (pipelines) for tightness. If the pipelines connections are not tight, tighten them. If it is not sufficient replace the sealing rings.

CAUTION: It is not permitted to apply sealing rings previously used.

When testing the pipelines for tightness, check the pressurization system non-return valves installed in the inboard engine nacelles on the air-to-air heat exchangers and at frame No. 32 of the fuselage pressurized section. The non-return valves shutters should be returned by the springs to the closed position from any open position.

When assembling the pipelines connections, remove old lubricant and cover the thread with light coating of MX-90 lubricant.

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Nos.	Description of operations	Types of maintenance			Engine change
		A	50	100	
	Prevent lubricant from getting inside the pipeline. Lock the threaded connections.				
3.	Test the by-pass shutters assembly and by-pass valve in a laboratory according to the parameters given in the drawings.				
4.	Reassemble all the shutters controlled by electric actuators and pack new oil seals.				
	Enter the results of checking according to steps 2, 3 and 4 in the Aircraft Log Book.				
	TOILET ROOMS AND WATER SUPPLY SYSTEM				
1.	Clean the dust pan and brush container with appropriate chemical liquid.	x	x	x	x
2.	Remove dust from the toilet basin, floor, walls, mirror and wipe the mirror.				
3.	Check the toilet pump and water trap for operation.	x	x	x	x
4.	Check the toilets, water supply, water pump and mirror for security of attachment.				
5.	Check the water supply system for operation and the supplies for the toilet and water pump.		x	x	x
6.	Check the water supply system for operation and the supplies for the toilet and water pump.				

SAC.	Description of operations	Types of maintenance			Engine change
		A	50	100	
	follows:				
	1. Wash the water tanks of the front and rear toilet rooms. Clean the interior of the tanks, examine the tanks for condition.				
	2. Wash the filters of the toilet room waste tanks.				
	FINAL OPERATIONS				
1.	Fill the aircraft with fuel and oil. Drain the fuel sediment from the tanks.	X	X	X	X
2.	See that chocks are placed around the L.G. wheels, that the ailerons, elevator and rudder are locked.				
3.	Install the canopy, cover and seal the aircraft.	X	X	X	X

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MAINTENANCE MANUAL

for

M-16 AIRCRAFT

Equipment

96-AAI

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- 1 -

G E N E R A L

This maintenance manual has been developed on the basis of practical operation of MN-18 aircraft and is the main document specifying the maintenance of these aircraft.

The manual contains the description of obligatory operations, the accomplishment of which improves the reliability of the aircraft units operation, provides for operational readiness of the aircraft.

The Manual contains the following types of aircraft maintenance:

1. Pre-flight maintenance
2. After-flight maintenance
3. Periodic maintenance of the aircraft after every 50,100 flying hours and when replacing the engines.

The above mentioned types of maintenance must be carried out in the following cases:

1. Pre-flight maintenance is performed directly prior to flight independently of the type of maintenance performed before, as well as before a flight after the aircraft has been delayed at the airport.

Note: If the aircraft is intended for take-off immediately after performing the after-flight or periodic maintenance, as well as in case of the aircraft delay at the airport for not more than five hours after being subjected to the pre-flight maintenance, do not perform the pre-flight maintenance.

2. After-flight maintenance is performed at the base and terminal airports after 20 ± 5 flying hours since the last after-flight or periodic maintenance operations.

3. Periodic maintenance is performed at the base and terminal airports after every 50 ± 5 , 100 ± 10 flying hours and when replacing the engines due to their service life expiration.

Note: When performing the periodic maintenance operations check the flying or operating hours of the separate instruments and units which have a limited service life to decide whether or not they must be replaced.

When performing the each type of maintenance carry out the operations given for the corresponding type of maintenance and remedy the defects detected during the flight and the aircraft inspection.

All the types of maintenance should be performed by using the necessary ground equipment, mechanization and tools.

The aircraft maintenance must be carried out by the specially trained technical personnel being familiar with the aircraft structure and equipment and the special features of the VA-18 aircraft operation.

Caution: Walk on the aircraft skin only in special soft footwear (rubber, felt, fabric footwear free from sand and dirt) or with the special walking mats covered on the skin.

Never do the following:

1) Rest the ladders and other ground equipment not padded with soft stuff against the aircraft.

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skin (especially against the fuselage pressurized section skin).

2) Perform the operations on mounting, inspection, checking and repair of the oxygen equipment with the hands and tools having oil and grease spots.

3) Perform the operations which need disconnection of the pipe line with a pressure in the oxygen system.

4) Charge the aircraft and portable ^{oxygen} bottles up to a pressure of not less than 30 kg/cm².

PRE-FLIGHT MAINTENANCE

Electrical Equipment

1. Inspect the position of all switches, selector switches and rheostats.

All rheostats should be set in zero position, and switches should be ON except the following:

- fire horn switch;
- decompression bell switch;
- anti-skid control switch;
- battery switch;
- eight switches for CT-12TM0 starter-generators.

2. Be sure that all circuit breakers are ON.

3. Check the voltage of each battery group under the load of 200A for 2-3 sec. If the voltage is low than 20V the battery should be replaced.

4. Inspect visually the navigation lights for reliability.

5. Check the landing lights for condition and attachment.

6. Be sure that the electric wiring on the L.G. struts is reliable.

7. After checking the pins and external power supply receptacle sockets for clarity, connect the external power supply source^{x)} of 28-28.5 v to the aircraft electrical system and by switching the voltage be sure that the following units and systems operate reliably:

- electrical actuators for flaps, ailerons and rudder trimmers, control surfaces locks, engine oil temperature control;
- electrical actuators for shut-off valves, cross feed valves, fuel pumps;
- electrical actuators for cabin pressurization valves, heating system air by-pass shutters, engine air intake de-icers, individual fans;
- sluicing pumps;
- main and auxiliary [MF-1000] inverters;
- [10-1500] inverter;
- navigation lights and landing lights;
- L.G. down position warning lights;
- warning lights for entrance and cargo doors position, and stewardess call;
- lighting in passenger cabin, cockpit and cargo compartments.

x) When connecting two external power supply sources before starting the engine it is necessary to connect the more powerful source to the rear receptacle.

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- When running, line check the reliability of :
- generators; the electrical system voltage with generators operated in parallel should be 115 V;
 - alternators; the voltage across A.C. bus bars should be 115 V;
 - propeller and spinner heater (switch on the heater only for one cycle);
 - electrically heated window panels and AOC-312 automatic windscreen heat control units;
 - system of incomplete and automatic feathering.

Radio Equipment

1. Inspect visually the aircraft antennas for condition and cleanliness. Remove dirt, ice and snow from the antennas and radome.
2. By switching on the radio equipment in turn (transmitters and receivers of the communication and command radio sets, ADF, radio altimeter, radar and intercommunicating system) be sure that they operate reliably and check the control test system, signal lights and scale lights for normal operation.
3. Check the traffic control equipment for reliability and determine the aircraft flight number.

Instrumenta, Oxygen and Fire Extinguishing Equipment

1. Inspect visually the instrument equipment for condition and the instrument panels for security of attachment in the cabins.

Wipe the instrument panels face and instrument glasses.

2. Check the correspondence of the BA-10 altimeters barometric scale readings to the barometric pressure on the airport. Permissible deviation is ± 1.5 mm Hg.

3. Switch on the TH-156 Pitot tubes heaters and check the heaters and warning lights for reliability. Switch on the heaters for a period of not more than two minutes.

4. Check the pressure instruments for reliable operation from the Pitot tubes and static holes.

5. Check the KM-13 compass light.

6. Check the artificial horizons and turn-and-bank indicators for serviceability.

7. Energize the autopilot and check:

a) erection of the both master vertical gyros (MVG) according to YT-1 attitude indicator;

b) MK-52A directional gyre for serviceability and compare the readings of the YTHK indicator with those of the MK-52A on the cardinal points (each 90 deg.). The reading difference should not exceed 2 deg.

8. Unlock the elevator, rudder and ailerons and deflect them several (6-8) times manually up to mechanical stops. The control surfaces should move without seizing. Set the control surfaces in neutral position and by turning O. the "Longitud. stab.", "Lateral stab." and "Preparation"

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switches on the autopilot control panel, check the automatic centering and the blocking circuit of the servos brake solenoids switching for operation.

9. By centering and switching on the autopilot check the "Turn", "Descent-Ascent" and "Bank" controls for operation according to the deflection of the proper control surfaces, and also check the altitude corrector for switching ON and OFF.

10. Check the autopilot emergency disengage buttons on the pilot's and co-pilot's control wheels for operation (with the autopilot ON).

11. Check the serviceability of the KC-6 compass system operating in the regime of magnetic correction (MK), directional gyro (ITK) and, with good visibility of the sun, astro correction (AK). Compare the readings of the compass system operating with magnetic and astro correction with the magnetic heading of the aircraft.

The readings difference taking into account a coefficient for magnetic correction should not exceed 12 deg. by the NM Navigator's indicator. Compare the readings of the NM indicator with those of the IK indicators for the pilot and co-pilot. The readings difference should not exceed 12 deg.

12. Check the EM-50M-1 ground position indicator for serviceability.

13. Check the PTMC-1.2A-EM flow meters and the total fuel consumption indicator (when running the engine).

14. Check the CTC-280 fuel contents gauge for serviceability and the indicator reading.

correspondance to the actual fuel quantity in the tanks.

15. Check the electrical instruments energized for reliable operation.

16. When running the engines be sure that the engine instruments operate reliably.

17. Inspect visually the KH-21, KH-32 and KH-24 oxygen regulators and KH-32 oxygen indicators for condition.

Check the oxygen reserve in the aircraft and portable bottles by the pressure gauges and, if necessary, charge them with oxygen up to a pressure of 30 kg/cm².

Check the operation of the KH-32 and KH-24 oxygen regulators and oxygen indicators in the cockpit and galley pantry.

18. Check and wind up the clocks.

19. Check the pressure in the fire extinguishers by the pressure gauges. The pressure should correspond to that indicated in the Certificate at given temperature.

Barespeedograph model K2-75.

20. Remove the instrument from the casing and inspect visually the mechanism for condition. The reduction gear should be set for the drum rotation speed of one revolution per 120 min.

21. Wind up the clock mechanism, put the record chart on the drum, fill up the pens with ink and check the pointers initial position and also check the pointers-to-drum tension. The pointers should be at close contact with the record chart when the instrument is inclined up to 45°.

22. Check the reliability of the clock mechanism starting, insert the instrument in the casing.

secure it by the latch, connect the pitot pressure hose, and seal the instrument.

Initial The clock mechanism is started before flight and stopped after flight by the navigator.

AFTER-FLIGHT MAINTENANCE, MAINTENANCE AFTER 50, 100 FLIGHT HOURS AND
BEFORE REPLACING THE ENGINE

No. Description of operations

Electrical Equipment

- | | | | | |
|---|---|---|---|---|
| 1. Inspect visually the batteries for condition, electrolyte leakage and overheating traces, the power wires and attachment fittings for serviceability. | X | X | X | X |
| 2. Check the voltage of each battery group under the load of 200A for 2-3 sec. If the voltage is lower than 20 V send the battery for charging. | X | X | X | X |
| 3. In the cockpit check the warning lights, cabin lights, H.V. lights, switches rheostats, buttons and individual fans for reliability and security of attachment, be sure that the fuses in the navigator's ASB (main switch board) and the set of spare fuses | X | X | X | X |

- 1) marked with "X" are operations to be performed.
2) A-After-flight maintenance

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	and bulbs are available. Set the shutters of all warning lights and AP ^{V40E} -45 W.V. lights in fully open position.				
2.	Check visually the navigator's and radio operator's MSDs and the pilot's electric panels. Make sure that all the electric elements installed on them are reliable and the electric instruments pointers are at zero with the electrical system de-energized.	x			
3.	Inspect visually the electrical wiring on the engine for condition, and plug connectors at the electrical outlets and at No. 3 frames of engine nacelles for secure connection. Make sure that the 500000 ohm resistors are free from damage and the electrical system wires are connected to the resistors.				
4.	Inspect visually the 120000 ohm resistors and alternators for condition and security of attachment. For damage, the brush cover bands for these resistors is the coping.				

	Types of maintenance			
	A	50	100	Engine change
1. Inspect the engine oil cooler.				
2. Check the rubber tubing through which wires lead on the oil frame of engine nacelles for damage.	x	x	x	x
3. Inspect the unit model 1100 and engine oil cooler control box model 1100 for attachment. Check the 1100 control box for cleanliness.	x	x	x	x
11. Inspect the limit switches in the L.O. wells and connecting wires for security of attachment, and plungers for easy movement. Remove dirt and oil from the limit switches.	x	x	x	x
WARNING: Before checking the limit switches plungers be sure that the aircraft is de-energized, pressure in the hydraulic system is released and locking pins are installed in the L.O. locks.				
12. Inspect wiring on the L.O. struts for security of attachment and plug connectors for safety locking.	x	x	x	x
13. Inspect the navigation lights, landing lights and tail light for condition and their glasses for damage and cleanliness.	x	x	x	x

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
14.	In the engine nacelles, nose wheel well and cargo compartments inspect the dome lights and 27 V power supply receptacles for condition and cleanliness. Check the electric units and wiring for condition and attachment, plug connectors and wires for security of connection to the units.	x	x	x	x
15.	Inspect the CPAIL-500 external power supply plug connector. Make sure that the cover lock and contact pins are in good condition. Wipe all the contact pins with a piece of dry cloth.	x	x	x	x
16.	Connect the external power supply source of 28-28.5 V to the aircraft electrical systems and by switching the voltage ON for a short time be sure that the following units and systems operate reliably: - electric actuators for flaps (with one or two electric motors running), aileron and rudder trimmers, control surfaces locks, engine oil temperature control; - electrical actuators for shut-off valves, cross feed valve, fuel pumps;	x	x	x	x

No.	Description of operations	Types of maintenance
	- electrical actuators for cabin pressurization valves, heating system air by-pass shutters, engine air intake de-icers, individual fans. - MK-1 electrical actuators for individual ventilating system; - slushing pumps; - main and auxiliary RT-1000 H inverters; - HO-1500 inverter; - navigation lights and landing lights; - L.S. down position warning lights; - warning lights for entrance and cargo doors position and stewardess call; - lighting in passenger cabin, cockpit and cargo and other compartments; - light and sound warning system; - elevator trim neutral position warning light; - manual actuation of the MPT-1 cabin heat control unit.	30 1000 1000

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
17.	Open the covers of the battery boxes, A.C. MJB, fire extinguishing system MJB, and junction box. Make sure that the circuit breakers are connected and all the terminals in good condition. Check the presence and correspondence of the fuses in the A.C. MJB and the battery box.	-	x	x	x
18.	Wash with alcohol the contacts of the 1074 unit electrical section.	-	x	x	x
19.	When running the engines check the reliability of:	-	x	x	x
	- D.C. generators. The electrical system voltage with the generators operated in parallel should be 28-28.5 V;				
	- alternators. The voltage across the alternator bus bars should be 115 V;				
	- automatic change over of the T_2 and T_3 bus bars power supply from the 110-1500 and GPO-37 alternator of No. 2 engine;				
	- propeller and spinner heater (switch on the heater only for cold cycles);				
	- electrically heated window panels and 220-240 engine				

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	windscreen heat control units.				
	- system of incomplete and automatic feathering.				
20.	Remove the 12CAM-28 batteries and send them to a battery charging station for maintenance.	-	x	x	x
21.	Inspect the RT-1000 inverters, check the commutators for condition and cleanliness, check brushes length and condition of springs. Replace the main and auxiliary inverters by each other. Change the brushes which length is less than 18 mm.				
22.	Inspect the MK-2 electrical actuators for the cross feed valve, shut-off valves, oil coolers, pressure refueling valves, engine air intake de-icers valves, propeller brake mechanism. Make sure that electric motors brush, cover lands are not damaged and fit closely to the case and locking is safety. Clean off dirt from the actuators.	-	-	x	x
23.	Inspect the TJB (tail junction box) for external damage, switches and wires for security of attachment. Check the fuses in TJB for condition.	-	-	x	x

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No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
24.	Inspect the stewardess switch panel and the pantry electrical equipment for reliability and security of attachment.	-	-	X	X
25.	Open the MJB covers in the engine nacelles and check the attachment of the elements and connection of wires to the switches, ammeters shunts, relays, contactors, distributing bus bars. Make sure that the circuit breakers are connected and are clean, and fuses are reliable.	-	-	X	X
26.	Inspect visually for damage, security of attachment, condition of wiring and plug connectors looking of the following equipment:	-	-	X	X
	- all programmers;				
	- KPT-1 and KBT-1A boxes;				
	- APT-75 and MCP-2A panels;				
	- main junction boxes Nos. 62 and 65;				
	- MK-12 electrical actuators;				
	- cabin pressurization valves;				
	- PH-600 and PH-18 carbon voltage regulators.				

Clean off dirt and dust from the equipment, if necessary.

No.	Description of operations	Types of maintenance			
		A	50	300	Engine change
27.	Open the cover of wing and tail unit heating contactors box. Check power wires for security of connection to contactors and heating elements.	-	-	-	x
28.	Inspect the commutator-brush assemblies of the M3-9A electrical actuator motor and remove dust. Replace the brushes worn down to 16 mm long.	-	-	-	x
29.	Open the MJB covers and check the relays and contactors for security of attachment, wires for security of connection.	-	-	-	x
30.	Open the dome lights, soffits and other lights in the passenger cabin, toilets and check the protective glasses for damage, attachment and cleanliness, the sockets, locks and latches for condition; make sure that there are not traces of moisture, overheating and deformation, that wire soldering and insulation are in good condition. Replace the lamps with sagged filament and blackened bulb.	-	-	-	x
31.	Inspect the ACC-AM automatic windscreen heat control units, windscreen heat transformer, temperature limiter, ABH-4 timer,	-	-	-	x

40. Description of operations

- XTBK-43M thermostat for security of attachment, the check means for condition, the plug connectors for tightening, wires for security of connection to electrically heated glass panels terminals. Check the AOC-83M unit adjustment.
32. Open all the electrical panels and the circuit breaker panels. Check all the elements for attachment and fuses for condition. Be sure that the bus bars are free from overheating, wires and harnesses insulation are not damaged and worn.
33. In all places accessible for inspection, check the wiring attachment for condition, harnesses for freedom of movement, bandages and protective coating for damage, wiring insulation for drying and burning at the heating elements.
34. Note the defects in the battery container. Remove the corrosion proof painting of the container parts and replace damaged sections of the heat insulation, if necessary.
35. Open the access doors and make sure that the de-icing system contactors are attached securely and terminals are free from overheating traces.

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
36.	Check the electric actuators for rudder and aileron trimmers, control surfaces locks, and control surfaces locks limit switches for condition and security of attachment.	-	-	-	X
37.	Check the signal flares for presence and correspondence of colours. Be sure that the flare release circuit is reliable (according to warning lights).	-	-	-	X
38.	Blow out the HC-1500 inverter with compressed air to remove brush dust, check the commutator for condition, measure brush length and if they are worn down to 10 mm long, replace them.	-	-	-	X
39.	Before removing the engines from the aircraft disconnect wiring from the units and tie it so that it does not hinder the engine removing.	-	-	-	X
40.	With the engines removed clean and check all wiring, terminals, plug connectors and heat insulation for condition, also check soldering of terminal lugs in wires and wires in plug connectors for security. Replace defective wires, terminal lugs, plug connectors, heat insulation, and remove defective soldering in plug connectors and terminal lugs.	-	-	-	X

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No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
41.	After installing the engines on the aircraft connect wires to the units mounted on the engines, secure the plug connectors, insulate the generators belt connections and secure wires on the engines.	-	-	-	x
42.	When running the engines be sure that all the units installed on the engines are serviceable.	-	-	-	x
43.	After every 400 hours, additionally to periodic maintenance, perform the following operations: - check the cross feed fuse (by disconnecting one end of the fuse) - Blow out the GM-44 electric motor brush holders cavities of the HΦ-2TA pump to remove brush dust and replace the worn brushes.	-	-	-	-
44.	After every 1000 hours, additionally to periodic maintenance, perform the following operations: - check the wing and tail unit de-icing system on the ground (by connecting lamps); - check electric meters in the laboratory for the	-	-	-	-

No.	Description of operations	Types of maintenance			
		▲	50	100	Engine change
	check accuracy according to the tolerances.				
	<u>Radio equipment</u>				
1.	Inspect the following aircraft antennas for damage, cleanliness and security of attachment:	x	x	x	x
	- nose radome;				
	- antenna mast, partition insulator, antenna wire and suspension insulators of the wire antenna;				
	- upper stub antenna fairing;				
	- flush-mounted marker receiver antenna plastic glass protective cover.				
	- flush-mounted ADF antennas wells covers;				
	- radio altimeter dipoles, especially the insulating ring.				
	Remove dirt, snow and ice from the antennas, if necessary.				
	<u>Note:</u> when performing the after-flight maintenance inspect visually from the ground the VHF (on the fin), wire and stub antennas.				
2.	In the cockpit and in the nose, tail, forward baggage compartments and in the compartment under the centre	x	x	x	x

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	section check the radio equipment, control panels, instruments and plug connectors for condition and security of attachment. Check the cable shields, bonding strips for damage, the antenna connecting wires and flexible shafts for security of connection.				
3.	Inspect the telephones and throat microphones, check the seal of the spare valves box for condition.	x	x	x	x
4.	Perform an electrical check of the radio equipment. Switch on in succession and perform the operational check of the radio equipment at different modes of operation and in the different frequency bands. Make sure that the radio controls, volume control, instruments, signal lights, and scale lights operate normally. <u>PCB-5 and PCB-70 radio sets.</u> Check the serviceability of the radio sets in the telephone and telegraph operation. Be sure that the PCB-70 radio set remote control mechanisms and the stub and wire antennas selecting system are reliable. <u>Command VHF radio sets.</u> Check the serviceability of the	x	x	x	x

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	radio sets on the operating channels by means of a side tone. Make sure that the channel selection mechanism is serviceable, changing from reception to transmission is reliable, antenna selection relay operate reliably. Check the quality of command communication. On the operating bands of No.1 and No.2 radio sets.				
	<u>APA-5 automatic direction finders.</u> Perform the operational check of the ADFs at different modes of operation. Check the spare scale lights for presence.	X	X	X	X
	<u>CH-50 and ILS instrument landing systems equipment.</u> Perform the operational check of the whole set of equipment.	X	X	X	X
	<u>Radio altimeter.</u> Check the radio altimeter for serviceability by observing the indicator pointer deflection on the both bands after switching on a power supply. Check the height warning device for serviceability.	X	X	X	X
	<u>Radar.</u> Check the radar for serviceability (according to the Mfr's plant instructions).	X	X	X	X
	<u>Intercom system.</u> Perform the operational check of the ICS by				

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No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	communicating with all crew stations. Check the volume controls and selector switcher for reliability. By checking the system units be sure that intercommunication operates reliably.				
5.	Check the colour of the ADF dehydrator crystals. Dry crystals, if necessary.	-	X	X	X
6.	Check the drain hoses in ADF stub antennas fairings for cleanliness.	-	X	X	X
7.	Using the simulator check the CH-50 and ILS instrument landing systems equipment (according to the Instruction on testing of the localizer and glide-path equipment of the CH-50 and ILS systems on the aircraft during the periodic maintenance operations).	-	X	X	X
8.	Check No.1 and No.2 VHF radio sets tuning by the "H" unit.	-		X	X
9.	Remove the cover from the antennas synchronizing device and check the places of the cables and jumpers connection for cleanliness, condition and good contact.	-	X	X	X
10.	Inspect the commutator-brush assembly of the ILS-500 and I-500 dynameters of the ILS-500, ILS-2 receivers and	-	X	X	X

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	PB-2 transmitter-receiver for condition and blow them with compressed air.				
11.	In the cockpit and behind the bulkhead check the antennas leads-in for security of connection to the units, partition insulators and antenna relay box.	-	-	x	x
12.	Check the blast tube for security of connection to the PCW-70 radio set units.	-	-	x	x
13.	Inspect the wire antenna shock absorber. Check the tension of the wire antenna by the shock absorber rod stroke. Renew WATN -201 lubricant, if necessary. Check the coaxial cables connectors for reliable connection to the antennas.	-	-	x	x
14.	Inspect the wire connection and make sure that there is no corrosion on the bimetallic wire and steel cable. Make sure that antenna circuit elements are securely connected and the suspension insulators are in good condition.	-	-	x	x
15.	Remove the fairing sections, specially designed for inspection from the upper and lower stub antennas. Check the antenna joints and connection to the partition insulator for cleanliness.	-	-	-	x

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	Types of maintenance			
	A	50	100	Engine change
16. Check the insulation of the wire harness lying along the control columns for condition. Make sure that the insulation is not damaged and the wires are not broken.	-	-	-	x
17. Inspect the relays installed in the 14-T starting relay box and the antenna relay box. Check the relays for damage, security of attachment and cleanliness.	-	-	-	x
18. Inspect all the relays and filters of the 14-600 and PYK-300 dynamotors. Clean and wash with alcohol the relay contacts, if necessary.	-	-	-	x
19. Inspect the aircraft switches and the radio equipment selector switches for their reliability and connecting wires for security of connection.	-	-	-	x
20. Remove and send to the shop for testing in accordance with the main technical parameters, accept from the shop and install in the aircraft the following radio equipment: - PB-2 radio altimeter with the indicator and dynameter	-	-	-	x

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	as well as the height warning device with the altitude preset unit.				
	<u>After every 500 flying hours, additionally to the schedule maintenance</u>				
21.	Remove and send to the shop for testing in accordance with the main technical parameters, except from the shop and install in the aircraft the following radio equipment: - transmitters, transmitters and dynamotors of the PC5-5 and PC5-70 radio sets; - transmitters and receivers of the VHF radio sets; - AN-3 automatic direction finders and 30V remote control system; - marker receiver; - RPK-2 receiver with dynamotor; - RPK-2 receiver with dynamotor; - AN-4 indicator; - AN-4 amplifier; - Spare valves.				

No. Description of operations

Instrument Equipment

1. Inspect visually the instrument equipment for condition and the instrument panels for security of attachment in the cabins.

Wipe the instrument panels face and instrument glasses.

2. Check the correspondence of the IM-10 altimeters barometric scale readings to the barometric pressure on the airport.
(permissible deviation is ± 1.5 mm.Hg.).

Make sure that the rate-of-climb indicators pointers are at zero

(permissible deviation is ± 0.5 m./sec., the combination air speed indicators pointers are at zero (permissible deviation is ± 2 scale divisions), the pointers of the cabin air flowmeters are at zero (permissible deviation is ± 1.5 scale divisions).

The pointers of the MC-1 machmeter should point down.

3. Check the IM-150 Pitot tubes for attachment, the air intake and drain holes for cleanliness. Switch on the IM-150 Pitot tubes heaters and check the heaters and warning lights for reliability. Check the IM-150 Pitot tubes covers and static holes for presence.

x x x x

No.	Description of operations	Types of maintenance			
		A	70	100	Engine change
4.	Check the pressure instruments for reliable operation from the Pitot tubes and static holes.	x	x	x	x
5.	Check the KM-13 compass light.	x	x	x	x
6.	Perform the electrical check of the artificial horizon, turn-and-bank indicators and other electrical instruments.	x	x	x	x
7.	Check the CFTC-200 fuel contents gauge for serviceability and its readings for correspondance to actual fuel quantity in the tanks.	x	x	x	x
8.	Energize the autopilot and check: - erection of the both master vertical gyros (MVG) according to AI-I attitude indicator; - HMR-52AH directional gyro for serviceability and compare the readings of the HMR indicator with those of the HMR-52AH on the cardinal points (each 90 deg.). The reading difference should not exceed 2 deg.	x	x	x	x
9.	Unlock the elevator, rudder and ailerons and deflect them several (6-8) times manually up to mechanical stops. The control surfaces should move without seizing.	x	x	x	x

No.	Description of operations	Types of maintenance			Engine change
		A	30	100	
	Set the control surfaces in neutral position and by turning ON the "Longitud. Stab.", "Lateral Stab.", and "Preparation" switches on the autopilot control panel, check the automatic centering and the blocking circuit of the servo brake solenoid switching for operation.				
10.	By centering and switching ON the autopilot check the servo brake efficiency by overriding the servos and check the "Turn", "Descent-Ascent" and "Bank" controls for operation according to the deflection of the proper control surfaces, and also check the altitude corrector for switching ON and OFF.	x	x	x	x
11.	Check the autopilot emergency disengage buttons on the pilot's and co-pilot's control wheels for operation (with the autopilot ON).	x	x	x	x
12.	Check the serviceability of the KC-6 compass system operating in the regimes of magnetic correction (MK), directional gyro (IUK) and, with good visibility of the sun, astro correction (AK). Perform the check first with the main gyro unit and then with the auxiliary gyro unit operated. Compare the readings of the compass system operating with magnetic	x	x	x	x

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	and astro correction with the magnetic heading of the aircraft. The reading difference taking into account a declination (for the astro correction) should not exceed ± 2 deg. by the YH navigator's indicator with those of the YH-I indicators for the pilot and co-pilot. The reading difference should not exceed ± 2 deg.				
13.	Check the HM-502M-I ground position indicator for serviceability.	x	x	x	x
14.	Inspect the attachment and shock absorbers of the units in the front lower baggage compartment. Be sure that they are not damaged and the plug connectors locking is in good condition. Inspect the HM-502M-I erection cut-out switches (main and auxiliary).	x	x	x	x
15.	Inspect the H-5 bulb of the outside air thermometer and the H-1 thermometer bulb of the ground position indicator for damage and security of attachment.	x	x	x	x
16.	Check the attachment to the engines of the following transmitters for:	x	x	x	x
	- oil pressure gauges and oil thermometers of the HM-502M-I engine gauge units;				
	- "Min. fuel pressure" and "Min. oil pressure" warning system (CMV pressure switches);				

No.	Description of operations	Types of maintenance			
		1	20	100	1000
	- all rating feathering (QLV switches); - torquemeter system; - PTMC-1.2A - 1 fuel flowmeter; - MTB-1 tachometers; - MTB-2 fuel control lever position indicators (make sure that the MTB-2 readings correspond to the position of the KTA fuel control unit limb lever). - TBT-26 exhaust gas thermometers. Check the hoses and pipes for security of connection to the transmitters and QLV pressure switches, the wiring and plug connectors locking for condition.				
17.	Inspect the L.C. position transmitters and make sure that the connection of the rods to the transmitter links is reliable, the plug connectors and coupling nuts are good tightened and the locking is in good condition.	x	x	x	x
18.	Inspect the brake pressure gauges transmitters (main and parking), emergency braking and feathering pressure gauges transmitters for security of attachment, the coupling nuts and plug connectors for	-	x	x	x

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No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	tightening and the locking for safety.				
19.	When running the engine be sure that all the engine electric instruments operate reliably and the total consumption counter of the PTMC-1.2A-31 operates correctly.	-	x	x	x
20.	Inspect the flap position indicator for tightening and the plug connector locking for condition.	-	x	x	-
21.	Inspect:	-	x	x	x
	- autopilot control unit (check the position of the trim potentiometers and the sensitivity potentiometers, check their locking for safety);				
	- MB-4 master vertical gyros;				
	- altitude corrector (check the connection of the hose to the altitude corrector fitting for security);				
	- servos amplifier;				
	- rate gyro unit.				
	Make sure that the mounting frame shock absorbers are in good condition and the locking of the plug connectors at the units is available.				
22.	Check the MA-2 flux-gate detector for security of attachment and for damage. Be sure that there is no liquid on its surface.	-	x	x	x

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No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
23.	Inspect visually the autopilot servos. Check the attachment bolts for tightness and the servos covers heating elements for condition. Inspect the servos control cables and check the turnbuckles locking for condition.	-	x	x	x
24.	Inspect and clean the contacts of the servos limit switches and the amplifier relay. Check the limit switches cams for attachment and the feedback potentiometer contact brush for proper installation, the rods and levers of the servos brake and operating solenoids for free movement. Install the servos covers and electrically heated covers, connect the latter to the aircraft electrical system. Check the servos bonding strips for condition.	-	x	x	x
25.	Make sure that the direction unit of the HM-50SM-I ground position indicator has no self rotation (check the adjustment of the junction box null signal).	-	-	x	x
26.	Check the attachment and shock absorbing of the instrument panels and separate units in the cockpit and in the front section of the passenger cabin for condition. Check the plug connectors locking for security.	-	-	x	x

	Description of operations	Types of maintenance			
		A	50	100	Engine change
27.	Check the static and dynamic (from the RA-150 Pitot tube) lines for air tightness.	-	-	x	x
28.	Remove from the aircraft, send to the shop for maintenance and testing in accordance with the main technical parameters, accept from the shop and install in the aircraft the following equipment: - RA-150 master vertical gyros; - rate gyro unit; - autopilot servos.	-	-	x	x
29.	Check the exhaust gas thermometers bulbs for security of attachment. Inspect visually the compensating leads from the bulbs to the junction blocks.	-	-	x	x
30.	Inspect the junction boxes and the relay unit of the compass system for damage and the plug connectors looking for presence.	-	-	x	x
31.	Check the altitude corrector for serviceability on the aircraft.	-	-	-	x
32.	Open the instrument panels of the pilots, navigator and flight engineer, and check the hoses and instrument fittings for condition.	-	-	-	x
33.	Together with the navigator test the RA-500M-I ground position indicator for errors.	-	-	-	x

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No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
34.	Remove from the aircraft, send to the shop for maintenance and checking in accordance with the technical parameters, accept from the shop and install in the aircraft the following equipment:	-	-	-	x
	- VTK and VI-I indicators;				
	- RLL-52AH directional gyro with its control panel;				
	- autopilot servos amplifier;				
	- altitude corrector;				
	PTMC-1.2A- B1 fuel flowmeter transmitters and indicators;				
	- transmitters of the VMT fuel control lever position indicators;				
	- tachometer generators;				
	- oil temperature bulbs and oil pressure transmitters;				
	- torquemeter transmitters;				
	- pressure switches of "Min.oil pressure" and "Min.fuel pressure" warning system;				
	- pressure switches of the all rating feathering.				
	Note: Pressure transmitters are tested in conjunction with their indicators.				

No.	Description of operations	Types of maintenance			
		A	500	100	Engine change
36.	Check the adjustment of the KC-6 fuel contents gauge on the KC-6 fuel tank.	-	-	-	x
	Check the signals from the fuel contents gauges and oil gauges for correct actuation.	-	-	-	x
37.	Check the gyro drifts of the main and auxiliary gyro units with the KC-6 compass system operated in the directional gyro regime, check the nominal and high speed of the compass system synchronizing.	-	-	-	x
38.	Compensate the scale errors of the compass system and the direction unit of the KM-5 flux-gate detector and KM-4 correcting mechanism.	-	-	-	x
	<u>NOTE:</u> Carry out the above mentioned operations also when replacing the KM-2 flux-gate detector and KM-4 correcting mechanism.				
39.	Before removing the engines:	-	-	-	x
	a) Disconnect the compensation leads from the thermocouples;				
	b) Disconnect the plug connectors from the thermometer generators, fuel and oil pressure transmitters, oil temperature bulbs and secure the wires to the aircraft structure so that they should not hinder the engines removing;				
	c) Disconnect the wires from the oil gauges tank units;				

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No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
	d) remove the fuel and oil pressure transmitters and the oil thermometer bulbs from the engine.				
40.	Inspect the transmitters and bulbs, the electric wires and plug connectors, clean dirt from them.	-	-	-	x
	Check the soldering of the terminal lugs on the wires for condition and the wires for security of attachment to the plug connectors.				
	Replace the defective wires, terminal lugs and plug connectors, renew the defective soldering of the terminal lugs and connection in the plug connectors.				
41.	Prior to installation of the engines on the aircraft install on the engines and connect with proper pipelines the following units:	-	-	-	x
	- fuel and oil pressure transmitters;				
	- tachometer generators;				
	- thermometer bulbs.				
42.	After installation of the engines connect the fuel and oil pressure transmitters, the oil thermometer bulbs and the tachometer generators with proper plug connectors, lock them and connect the compensating leads to the thermocouples.	-	-	-	x

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No.	Description of operations	Types of maintenance			Engine change
		A	50	100	
43.	When running the engines check the engine instruments for serviceability.	-	-	-	x
44.	After every 400 flying hours remove from the aircraft and send to the shop for maintenance and checking in accordance with the main technical parameters, accept from the shop and install in the aircraft the following units: - BK-50PE erecting cut-out switches; - MTG-2 tachometers (in conjunction with the generators); - gyro units, amplifier, correction mechanism, flux-gate detector and indicator of the compass system, and also the HM-50BM-I ground position indicator (in the set); - all tank units of the COIC-280 fuel contents gauge; - TME-20 exhaust gas thermometer indicators.	-	-	-	-
45.	After every 800 flying hours remove from the aircraft and send to the shop for maintenance and checking in accordance with the main technical parameters, accept from the shop and install in the aircraft the following units:	-	-	-	-

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No.	Description of operations	Types of maintenance			
		A	50*	100	Engine change
-	ATB-2 artificial horizons;				
-	BC-46 altitude switches;				
-	KVC-1200 combination air speed indicator;				
-	MC-1 tachometer				
-	BA-10 altimeters				
-	BAP-30-3 and BP-10 rate-of-climb indicators;				
-	VBIL-20 cabin altitude and differential pressure indicator;				
-	YPEK cabin air flowmeter;				
-	TV3-48 and TB-19 thermometers indicators;				
-	BK-53PB erecting cut-out switches;				
-	BYH-58 turn-and-bank indicators;				
-	CGIC-200 fuel contents gauge indicators(with the tank units);				
-	EGC-1000 oil contents gauges;				
-	VTB-2 indicators (with the transmitters);				
-	FM-47 flap position indicators (with the transmitters);				
-	WIC-2 tachometers (in conjunction with the generators);				
-	GM-10 and GM-20 pressure gauges (with the transmitters);				
-	22AW-100 two-pointer electric pressure gauges(torquemeters) (with the transmitters);				

No.	Description of operations	Types of maintenance			
		A	500	100	Engine change
	- 3MI-3P three-pointer engine gauge units (in conjunction with the transmitters);				
	- THB-15 thermometer indicators.				
	<u>Engine Fire Extinguishing System</u>				
1.	Check the red disks of the OC-8M fire extinguishers self discharge indicators. If they are burst out it indicates that the fire extinguishers are discharged.	X	X	X	X
	<u>NOTE:</u> If the fire extinguishers are self-discharged blow out the system pipelines with compressed air.				
2.	Check the pressure in the OC-8M fire extinguishers by pressure gauges which should correspond to that indicated in the Certificate for a given temperature. Replace the fire extinguishers with low pressure.	X	X	X	X
3.	Check the fire extinguisher valve pressing screw seal and the lock nut safeting for condition. If there is no seal or safeting of the pressing screw lock nut the fire extinguisher must be replaced.	X	X	X	X

No.	Description of operations	Types of maintenance			
		A	30	100	Major changes
4.	Check the fire extinguishers, distributing valves assemblies for security of attachment and their connections for locking.	X	X	X	X
5.	Inspect visually the fire detectors, check the brackets for cracks, the plug connectors for security of connection and the locking for condition.	X	X	X	X
6.	Check the fire warning system (light and sound).	X	X	X	X
7.	Replace the III-3 cartridges in the OC-8N fire extinguishers.	-	-	-	X
8.	Perform the electrical check of the fire warning system (C-1 horns, light panels and beam lights on the fire extinguishing control panel) for serviceability as well as the system electric wiring by means of: - switching ON the system by IH-45 selector switches on the control panel; - switching ON the system by the crash switches installed on the main L.G. drag struts.	X	X	X	X
NOTE: Perform checking with the plugs disconnected from the cartridges and with the check lamps connected instead of them to prevent the fire extinguishers from discharge.					

No.	Description of operations	Types of maintenance			
		A	50	100	Engine change
9.	Perform the electrical check simultaneously the fire warning system (C-1 horns, light panel and green lights on the control panel) for serviceability.	-	-	-	x
10.	Check the fire detector on the test stand for reliable operation.	-	-	-	x
<u>Oxygen Equipment</u>					
1.	Check the aircraft and portable bottles for charging with oxygen. Recharge the bottles with medical oxygen up to a pressure of 100 p.s.i., if necessary.	x	x	x	x
	<u>WARNING:</u> Before charging be sure that the charging device parts are free from oil and grease.				
2.	Inspect visually the oxygen equipment in the cockpit, check the pressure gauge glasses and oxygen indicators glass cap for damage.	x	x	x	x
3.	Check the RI-1, RI-14 and RI-21 oxygen regulators, pressure gauges and indicators for security of attachment.	x	x	x	x
4.	Be sure that the RI-12, RI-24 and RI-21 oxygen regulators and indicators are serviceable. Inspect visually the bottles of the RI-21 portable regulators for dents and cracks.	x	x	x	x

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No.	Description of operations	Types of maintenance			Engine change
		1	50	100	
5.	Check the condition of the main and supply oxygen system pipelines in the cockpit and in the front baggage compartment. Be sure that the pipelines are free from dents, twisting and wear.	x	x	x	x
6.	Check the aircraft bottles, charging panel, valves and pressure gauges for security of attachment in the front baggage compartment.	x	x	x	x
7.	Check the main and supply oxygen system pipelines for air tightness.	x	x	x	x
8.	Remove the KIL-32, KIL-24M and KIL-2F oxygen regulators from the aircraft and check them in the laboratory. If they meet the specifications, install them in the aircraft.	x	x	x	x
9.	After 800 flying hours remove the oxygen equipment from the aircraft and forward to the laboratory for testing.	x	x	x	x

K2-79 BAROSPEEDOGRAPH

1. Remove the instrument from the case and record the barospeedograph number, date and flight route, type and aircraft number on the record chart. When the record chart is completed, replace it with new one. Check the reliability of the clock mechanism starting, insert the instrument into the case and lock it with the latch.

No.	Description of operations	Types of maintenance			Engine change
		A	50	100	
2.	Inspect the attachment of the barospeedograph, be sure that the static and dynamic lines are connected to the instrument.	x	x	x	x
3.	Check the static pipeline for air tightness.	-	-	x	x
4.	Remove the barospeedograph from the aircraft, send it to the shop for maintenance and test according to main technical parameters, accept from the shop and install in the aircraft.	-	-	-	x

General
Pre-flight maintenance
After-flight maintenance, maintenance after 90,000 flying hours and engine replacement
engine
Electrical equipment
Radio equipment
Instrument equipment
Engine fire extinguishing system
Oxygen equipment
K2-75 barospeedograph

96-AAI
IL-18 AIRLINER
WITH FOUR AI-20 TURBOPROP ENGINES
PILOT'S FLIGHT
OPERATING INSTRUCTIONS

1960

CHAPTER 1
GENERAL INFORMATION

- 3 -

1. PRINCIPAL DIMENSIONS

Height overall 10.17 m
 Length overall 35.9 m
 Wheel track 9.0 m
 Wheelbase 12.75 m
 Aircraft incidence at parking 0 deg.

Propeller clearances to ground:

a) inboard propeller 0.778 m
 b) outboard propeller 1.078 m

Height to sill above ground:

a) Passenger door 3.1 m
 b) Cargo hatch Nos 1,2 1.915 m
 c) Cargo hatch No 3 2.87 m

Dimensions:

a) Passenger door 0.76 x 1.40 m
 b) Cargo hatch 0.75 x 1.25 m
 c) Cargo hatch No 3 0.9 x 1.28 m
 d) Emergency exit 0.45 x 0.75 m

Wing

Span 37.4 m
 Area 140 sq.m.
 M.A.C. 4.052 m
 Aspect ratio 10.0
 Taper ratio 3.0
 Dihedral (wing leading edge). 3 deg.

Incidence:

centre section +3 deg
 outer wing at root 3 deg
 outer wing at tip +2 deg

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Aileron area 9.11 sq.m
 Aileron movement ± 20 deg
 Aileron trim-tab area 0.365 sq.m
 Aileron trim-tab movement ± 4 deg $\begin{smallmatrix} +1 \\ -0.5 \end{smallmatrix}$
 Flap area 27.15 sq.m
 Flap span 23.87 m
 Flap take-off setting 15-30 deg
 Max.flap landing setting 40 deg

Tailplane and Elevator

Area 27.8 sq.m
 Span 11.8 m
 Tailplane area 17.93 sq.m
 Elevator area (full chord) 9.56 sq.m
 Tailplane incidence to aircraft axis -1 deg.

Elevator movement:

up 25 deg
 down -15 deg
 Elevator trim-tab area 0.66 sq.m

Elevator trim-tab movement:

up 7 deg.30 min.
 down 13 deg

Fin and Rudder

Area 17.93 sq.m
 Fin height above aircraft axis 6.81 m
 Rudder area 6.65 sq.m
 Rudder movement ± 25 deg
 Rudder trim-tab area 0.31 sq.m
 Rudder trim-tab movement ± 9 deg $\begin{smallmatrix} +1 \\ -1 \end{smallmatrix}$
 Spring-tab area 0.4 sq.m
 Spring-tab movement ± 15 deg

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Fuselage

Length 35.0 m
 Diameter, max. 3.5 m
 Cross section area 9.6 sq.m
 Pressure cabin volume 240.0 cu.m

2. FLIGHT PERFORMANCE, NCA

Max. speed (true) at weight 56,000 kg,
 nominal rating, altitude 8,000 m 660 km/hr

Rate of climb at take-off weight
 61,000 kg, engines at nominal
 rating (initial climb speed, CAS
 at ground level 390 km/hr):

at ground level 7.0 m/sec

at 8,000 m altitude 2.3 m/sec

Service ceiling at take-off weight
 61,000 kg, engines at nominal rating 2,500-10,000 m
 (depending on engine
 regulation)

Time for climb at TOW 61,000 kg
 (according to the Table) 27-28 min

Take-off run at take-off weight
 61,000 kg. 1,200 m

Unstick speed at TOW 61,000 kg 235 km/hr

Landing run at WT 46,000 kg 720 m

Landing speed at weight 46,000 kg 190 km/hr

3. FLIGHT LIMITATIONS

Max. permissible level flight speed, CAS 510 km/hr

Max. permissible emergency descent speed 610 km/hr

Max. permissible Mach Number 0.65

Max. permissible speed, CAS, flaps down:

by 15 deg. 320 km/hr

by 30-40 deg. 300 km/hr

Max. permissible undercarriage lowering
 (retraction) speed, CAS 350 km/hr

Min. en route flight speed, CAS 325 km/hr

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Min. speed, CAS in training flights
on rectangular pattern (path) 350 km.p.h.

Max. permissible wind velocity in
take-off and landing (by 90° to runway) 15 m/sec

If necessary, it is permitted to run engines at take-off
rating for no more than 15 min. at any flight altitude.

Max. permissible acceleration (overload) in flight on the
scale of the acceleration instrument on the instrument panel,
should not exceed values given on the Chart, fig.1.

4. WEIGHT BREAKDOWN

Table 1

Nos	Weights	IL-18	Note
1.	Max. take-off weight with 12-ply tyres, kg	61,000	
2.	Max. landing weight, kg	51,000	
3.	Max. permissible unburnt fuel in wing tanks during landing, kg	10,000	
4.	Empty weight, kg	31,300	internal starting from 10 batteries
5.	Max. payload, kg	13,500	

1. Landing at landing weights greater than max. permissible
landing weight 51,000 kg, landing at max. take-off weight included,
is permitted in exceptional cases on condition that the pilot
exercises particular care.

2. To increase the life of service of the undercarriage and
wing, it is recommended to land systematically with fuel load in
the wing of no more than 6,000 kg.

3. Empty weights are given for preliminary calculations of
load. For actual empty weights to be allowed in calculation of
useful load, see the Aircraft Certificate.

4. Empty weight for the IL-18 is given without passenger
seats.

Take-off weight is made up of the following weights:

- empty weight (with fixed equipment and system of internal
starting from 10 batteries, passenger seats excluded);
- weight of removable equipment;

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- payload weight, including 200 kg of food supply;
- fuel weight.

Weights of service equipment for the IL-18 airliners, including weight of passenger seats in different layouts, are given in Table 2.

In the event of a change of the cabin layout during service, it is necessary to add weight of equipment and seats, taken from Table 2 for a new number of seats, to Empty weight.

Table 2

Number of passenger seats	111	105	89	84	79	78	73
Removable equipment (seats included), kg	1,640 ¹	1,840	1,630 ¹	1,830	1,780	1,810	1,760

N O T E: Aircraft empty weight includes weight of the internal starting system from 10 batteries. For aircraft with internal starting from 20 batteries it is necessary to add 350 kg (weight of 10 batteries plus 2 containers) to weights, given in Table 2.

1. removable equipment weight for 89- and 111-seat layouts changes with a change in number of seats and with installation of a smaller galley.

Removable equipment weights (air crew excluded) for the IL-18 are given in Table 3.

The weight of the service equipment for the IL-18 is given without the weight of the seats.

The weight of the seats and basic data of the passenger cabin layouts of the IL-18 are given in Table 4.

Table 3

Item	Detail description	IL - 18			
		10 batteries, small galley	Totals, kg	10 batteries, large galley	Totals, kg
1	2	3	4	5	6
Oil	in tanks	207.4		207.4	
	in oil coolers	49.0	320.0	49.0	320.0
	in engine oil units and pipes	63.6		63.6	
Galley equipment	Boxes with plates and linen	86.7		240.7	
	Boxes for second dishes	-		49.2	
	Air-oven (2)	-		30.0	
	Boilers	47.2	136.9	53.0	386.9
	Termosee container for literature	-		-	
	Box	3.0		5.0	
Water	Pure toilets:				
	1st toilet	29.0		29.0	
	2nd toilet	29.0	148.0	29.0	148.0
	Aft toilet	25.0		25.0	
	Humidification system	65.0		65.0	
Oxygen equipment and bottles (Greenalls)	Carpets	60.2		60.2	
	Literature	20.0		20.0	
	Portable oxygen bottles with instrument	27.0	112.0	27.0	112.0
	Oxygen in portable bottles	1.8		1.8	
	Oxygen in stationary bottles	3.0		3.0	
Service equipment	Airborne stairs	12.0		12.0	
	Escape slide	6.0	18.0	6.0	18.0
Baggage equipment	Charge cart in underfloor baggage holds	12.5	15.1	12.5	15.1
	Signal flares	2.6		2.6	
	Totals		750		1,000

Table 4

Galley	Layouts	Number of seats in the aircraft	Number of seats			Seats pitch, mm			Weight of seats, kg
			in the fore cabin	in the main cabin	in the aft cabin	in the fore cabin	in the main cabin	in the aft cabin	
Large galley	Mixed class	73	20	45	8	900	1020	1250	760
	Mixed class	78	20	50	8	900	900	1250	810
	Tourist class	79	20	45	14	900	1020	900	780
	Tourist class	84	20	50	14	900	900	900	830
	Economy class	105	24	65	16	900	840	900	840
Small galley	Tourist class	80	20	55	14	900	900	900	820
	Economy class	111	24	71	16	900	840	900	890

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The weight of additional equipment (for those aircraft in which it is used) is the following:

weight of the airborne radio set PC5-70 - 95,9 kg

weight of the VHF command radio set PCN4-40 - 21,5 kg

When the airborne engine starting system of 10 batteries is used instead of the engine starting system with zinc-zinc batteries, the weight of the aircraft is increasing and the payload is reduced accordingly.

Maximum payload weight versus fuel may be determined from the curves (fig.2).

This figure gives curves for determination of the payload weight of the IL-18 and IL-18B, using the airborne engine starting system of 10 batteries and having 12-layer tyres on wheels.

Take-off weight of the aircraft using 10-layer tyres must not exceed 59200 kg. This figure also gives a curve for determination of the payload of the IL-18A (also using the airborne engine starting system of 10 batteries).

5. C.G. LIMITS^{OF} THE AIRCRAFT

The IL-18 has the following permissible C.G. positions (in which the aircraft has good longitudinal stability)

allowable aft C.G. limit
(landing gear retracted) 23% MAC

allowable forward C.G. limit
(landing gear retracted) 16% MAC

(landing gear extended) 18% MAC

In order to maintain C.G. position in allowable limits throughout the flight it is necessary to load the IL-18 in accordance with Recommendations PU3 and provisional instructions for the loading of the IL-18.

6. AI-20 TURBOPROP BASIC DATA:

1. Compressor axial 10 stages
 2. Combustion chamber annular with 10 burner heads
 3. Turbine three stages
 4. Reduction gear planetary type with gear ratio of 0,0871
 5. Engine rotor R.P.M. at
low speed rating 70,5-80,5 (10400±200 RPM)
at all operating ratings
at the ground and in flight. . 95-965 (14300±200 RPM)
 6. Permissible time of
continuous engine
operation:
at take-off rating not more than 15 min. and total
quantity of engine's operation
hours must not exceed 4% of its
overhaul life
at nominal rating unlimited and total quantity,
of engine's operation hours at
this rating must not exceed 1%
of the engine's overhaul life
at ratings 74° according
to indicator УПРТ and
below unlimited
at low speed ratings
(at the ground) not more than 30 min
- NOTE: In the calculation of total quantity of engine's
operation hours in percentage of its overhaul life
it is necessary consider the ratings within 70-80°
according to the indicator УПРТ as nominal
ratings and the ratings 80° and above consider as
take-off ratings.
7. Time required to change from
low speed rating to take-off
rating during test for
acceleration. not more than 15 sec.
 8. Fuel grade (for start and
operation) Т-1, ТБ-1 and their mixtures
 9. Oil grade oil mixture by volume: 75% of
transformer oil or УМ-2 and
25% of oil УМ-22 or УМ-10
 10. Oil consumption not more than 1,2 litres/hr
 11. Oil inlet temperature
at steady ratings, °C:

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min.permissible 40

max.permissible (for not more
than 15 min. of continuous
operation) 90

recommended 70-80

With engines operating at the
ground at rating 0,2 of nominal
(and below) at fully opened oil
cooler doors the inlet oil
temperature for 15 min. must
not exceed 100°C.

At this temperature it is
permitted to take-off.

12. Oil pressure in main line:

	AI-20 series 2 and 3	AI-20 series 1
at all ratings at the ground, kg/cm ²	5-5,5	4-4,5
at low speed rating, kg/cm ²	not less than 4	not less than 3
at all ratings in flight	not less than 4	not less than 3

13. Propeller AB-68-1 for blades, feathering, diameter 4,5 m

14. Air bleed for pressurized cabins:

- a) Quantity of air bleed at ground level must not exceed
100 kg/hr;
- b) Quantity of air bleed in all range of flight altitudes
with engine ratings from the 0,2 of nominal to take-off rating
inclusive must not exceed 0,27 kg/sec.

15. Air bleed for the deicing system of the aircraft at nominal rating and under this must not exceed 0,36 kg/sec.

N O T E: At the ground and at the take-off in icing
conditions it is permitted to put the deicing system
in operation at any engine rating.

Pressurization and deicing system of the
aircraft must consume air bleed in quantity not
exceeding above mentioned value.

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- c) The engine stop cock must be set at "Operation Position",
- d) The propeller stop switch must remain in "Propeller on stop" position.

4. Proceed as follows to start an engine:

- a) press the "start-in-flight" button;
- b) unfeather the propeller partially by pulling buttons ~~NM-37~~ or ~~M-5~~. After r.p.m. reach 19.5-20 percent (2,500-3,000 r.p.m.), release buttons ~~NM-37~~ or ~~M-5~~ and the "start-in-flight" button.

If in the process of unfeathering the propeller, an ignition does not occur at 14-15.5 percent of r.p.m. (1,800-2,000 r.p.m.), stop starting by closing the engine stop-cock, feather the propeller and repeat start. Ignition is indicated by gas temperature downstream the turbine.

If r.p.m. show a tendency to increase, ^{pull the} "partial feather" button to "overweigh" the propeller and prevent a rise in r.p.m. above 103 percent.

5. After engine starting, set the engine control lever smoothly at a position providing the necessary rating.

Values of parameters and instruments, controlling engine operation

Parameter	Conventional marking of instrument	Instrument scales	Value against ratings							Note	
			take-off	nominal	0,85 of nom	0,7 of nom	0,6 of nom	0,4 of nom	low speed rating		
Turn angle of fuel control lever in degrees KTA-5 (Control fuel unit)	УПРТ-2	0-105	95-105	82-86	70-74	59-63	48-52	33-37	at the ground 0° in flight 15±1°		
Fuel consumption per hour, kg/hr, not more than	PTMC		1040	950	870	790	745			Fuel consumption is given for $V=0$ and $M=0$	
Fuel pressure fore the fuel nozzles kg/cm ²		0-100	not more than	at the ground approximately					Varies within 17-25	With climb to altitude fuel pressure fore the nozzles diminishes	
Engine rotor RPM in percentage	Indicator Sensor	0-105	95-96 (12300±90 RPM)						79,5-82,5 (10400±200 RPM)	Max. permissible engine while at any acceleration not more than 120% (12200 RPM)	
Exhaust gas temperature turbine °C	TBT-26	100-200	At take-off for all airfields not more than								Max. permissible exhaust gas temperature of the turbine at start 720°C
			190	At outside air temperature +15°C and below							
			220	At outside air temperature Above +12°C							
			In flight to 44000 ft not more than								
Oil pressure in engine, kg/cm ²	3MM-2P	0-10	470	440	420	-	-	-	At all ratings for series at the ground in flight not less than	low speed at the ground not less than	
Oil pressure in the torque meter indicator kg/cm ²	MMM	0-100	At take-off and nominal ratings and 60-65 respectively							75-80	
Engine inlet oil temperature, °C	3MM-5P		At the ground and in flight it is recommended 70-80°C								Min. +40°C Max. +60°C

NOTE: 1. Parameter values of engine operation at the ground are given for conditions $P=760$ mm. Hg. $t_{\text{outside}} = +15^\circ\text{C}$.

2. With engine operation at the ground at ratings 0,2 of nominal and below this the allowable inlet oil temperature is up to $+100^\circ\text{C}$ during engine steady operation, not more than 15 min. If the temperature it is permitted to take-off.

3. With the engine at any altitude a difference $\pm 1^\circ\text{C}$ from ISA the allowable exhaust gas temperature not the engine is correspondingly by $\pm 1^\circ\text{C}$. It is necessary to determine the allowable exhaust gas temperature in flight each number in accordance with instructions shown in the flight manual.

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CHAPTER 11
PREPARATION FOR FLIGHT

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1. PREFLIGHT PREPARATION

Preflight preparation includes following essential procedures:

- a) make up a flight plan, estimate weather conditions, determine optimum flight conditions and required fuel quantity and loading, calculate take-off run of the airplane at given take-off conditions;
- b) check-up loading fuel in accordance with the flight plan;
- c) check-up load distribution in accordance with allowable center of gravity limits of the aircraft;
- d) make up preflight inspection of the aircraft and its equipment.

2. ESTIMATION OF WEATHER CONDITIONS.

During the preflight preparation the captain of the aircraft must be thoroughly informed by Central aerometeorological station about en route weather conditions.

Information concerning the vertical section of the atmosphere must be presented to the captain within no more than 3-4 hours since the time of latest weather observations.

In case of absence of information obtained 3-4 hours before from aircraft ascents or by radio sounding, the decision regarding the possibility of flight is taken by flight director after thorough examination of atmospheric conditions with the captain of the aircraft and weather forecaster.

The captain must be advised particularly regarding following atmospheric conditions:

- location of the fronts relative to the proposed route;
- location of area affected by the jet stream and height of its axis and horizontal and vertical distribution of the wind direction and speed at basic flight altitudes;
- horizontal and vertical temperature distribution in the upper troposphere and particularly in the area affected by the

jet stream;

- topography, height and nature of the tropopause;
- location of the upper air baric formations - depressions (cyclones, troughs);
- height of the base and top of clouds at fronts;
- areas of development of heavy cumulus and cumulonimbus clouds and location of altocumulus and cirrus clouds relative to the probable route;
- areas where is possible airplane ice accretion and the height of their location;
- areas of thundery conditions, nature and strength of the atmospheric turbulence.

2. The captain making a flight plan must consider the recommendations, contained in chapter 17 "Flying through areas of atmospheric turbulence" p. of these Instructions.

3. ESTIMATION OF OPTIMUM FLIGHT CONDITIONS.

OPTIMUM FLIGHT ALTITUDE.

The optimum flight altitude changes depending on stage length, all-up weight and wind against height

On short route sectors under 600 km the optimum flight altitudes with no wind are:

Distance, km	100	200	400	600
Optimum flight altitude	4000	5000	6000	7000

Height levels prescribed for cruising flights must approach the optimum flight altitude.

On routes between 600 and 3000 km the optimum altitude is within 8000-9000 m. To obtain the highest cruising speed with engines operating at nominal rating it is necessary to fly at 6000-7000m altitudes.

In case the airplane flies with the payload over distances more than 3000 km, when increase of loaded fuel demands decrease

of the payload, it is recommended to select height and speed, both corresponding to the near - minimum fuel consumption.

In this case it is necessary after the take-off with the all-up weight to ascend to the prescribed level not exceeding 8000 m. After decrease of all-up weight owing to fuel consumption it is necessary to climb to the next level. It is advisable to ascend to 9000 level when the quantity of fuel burned is 8000 kg and the all-up weight is no more than 50t.

On long route sectors the minimum fuel consumption per km is obtained by using a cruise climb technique with slow and continuous climb at 220 m/hr.

With this cruise climb technique it will be necessary after the climb to the initial 8000-9000 m altitude to have engines operating constantly at cruising rating and maintain a constant Mach number.

The aircraft will fly at a constantly increasing altitude, as weight decreases and throughout the cruise will maintain the optimum altitude corresponding to its flight weight. The climb to altitudes will be gradual provided the ambient-air temperature is constant.

The cruise climb technique with a constant Mach number is permitted when the captain of the aircraft is not limited by the necessity to fly at prescribed levels. (§ 415 ICHH PA-58).

If strength of the effective head wind ($W-V$) increases against height by more than 25 km/hr per 1000 m it will be advisable to fly at a lower height in order to decrease the fuel consumption. The quantity $W-V$ is determined from Table 6 (see table 6). The wind angle is obtained by standard method used in the navigational calculations. The information regarding the wind direction and speed is obtained from a forecast of wind against height.

CALCULATION OF FUEL LOAD

The quantity of fuel to be loaded before the start is obtained by summing up

- total fuel burned in flight from the start to the landing. Fuel quantity burned in flight with no wind on any stage length is obtainable from table 7 (p.). Distance on this table is presented in thousands and hundreds of km;
- fuel quantity burned during the operation of engines on the ground before the take-off and after the landing at a rate of 30 kg/min;
- 300 kg of fuel left for taxiing after the flight (this fuel quantity may be burned out almost totally on taxiing);
- fuel reserves not less than 2000 kg.

EXAMPLE OF CALCULATION OF FUEL LOAD

Assumptions: range 2500 km, wind angle 100° and wind speed 140 km/hr. The difference between ground speed and air speed ($W-V$)=100 km/hr (see table 6).

The airspeed is $V=600$ km/hr (from table 9 p. at height 3000 m and all-up weight 55^t), consequently ground speed is $W=500$ km/hr and range with no wind is $2500 \frac{600}{500} = 3000$ km.

Total fuel burned on a stage length 3000 km is 10 700 kg (from table 7).

Time of operation of the engines ^{the} at ground is 15 min. The required fuel load is $10\ 700 + (15 \times 30) + 300 + 2500 = 13\ 950$ kg.

For flights with wind it will be necessary recalculate the route distance for conditions with no wind as is shown in the above stated example. For this purpose the route distance is multiplied by air speed and divided by ground speed.

The fuel consumption indicated on table 7 corresponds to the flight height and speed used at making-up Aircraft traffic schedule.

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Table 7

TOTAL FUEL CONSUMPTION IN FLIGHT
(with no wind), kg

Distance, km	0	100	200	300	400	500	600	700	800	900
0	800	1120	1520	1880	2220	2540	2860	3180	3510	3840
1000	4170	4500	4830	5160	5490	5820	6150	6480	6810	7140
2000	7480	7820	8160	8500	8840	9170	9470	9800	10100	10400
3000	10700	11000	11300	11600	11900	12190	12480	12760	13040	13320
4000	13610	13900	14190	14480	14770	15060	15350	15640	15930	16220
5000	16510	16800	17280	17560	17840	18120	18400	18680	18960	19240

More detailed information about the fuel consumption is presented on cruise graph (see Appendix 5).

**4. DETERMINATION OF TAKE-OFF RUN AGAINST
START CONDITIONS.**

Determination of take-off-run is based on following data:
 ambient temperature (°C),
 atmospheric pressure (mm hg),
 speed and direction of wind (m/sec),
 runway slope and its direction (in hundredths),
 take-off weight (kg).

Aircraft take-off run is determined by graphical method from a nomograph (fig.3).

The nomograph is based on the data, obtained at official and operational tests and it is assumed that the calibrated unstick speeds of the aircraft against take-off weight are as follows:

Take-off weight, t 61,0 58 56 54 52 50 48
 Unstick speed, km/h. . . 230-235 228 223 219 215 212 207
 Wing flaps at take-off are at 30° setting.

The nomograph will be used in following way:

On the graph "A" (above left) find on the horizontal scale

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the air temperature corresponding to the actual temperature and draw upwards from it a vertical line to intersect with the curve corresponding to actual atmospheric pressure at the airfield. From the intersection point draw a horizontal line to the right on the graph "5" to intersect with the curve corresponding to the actual take-off weight of the aircraft. From the point of intersection between the horizontal line and the weight curve draw a vertical line down to the graph "B" to intersect with the line corresponding to the wind speed component (head or tail).

From a resulting point draw a horizontal line to the left on the graph "1" to intersect with line corresponding to the actual runway slope, drop a perpendicular, from this point on the horizontal scale and read the take-off run corresponding to all above mentioned actual conditions.

The example of take-off run determination for the 12-18 is shown on the nomograph by arrows in assumption of following data (in still air):

outside ^{air} temperature	+15°C
atmospheric pressure	760 mm hg
runway slope	0,00
take-off weight	56 t
Estimated take-off run will be	1000 m

In case the determination of the take-off run shows that the runway length is insufficient for the take-off it will be necessary to decrease the aircraft take-off weight and to determine the take-off run with a lower weight.

5. TWILIGHT INSPECTION AND CHECKING OF AIRCRAFT AND ITS EQUIPMENT BY CREW.

Don't permit during the ground handling:

- a) walk on aircraft skin without special soft shoes or without soft mats;

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b) touch aircraft skin by service ladders, refuelling guns and by other airfield equipment because of severe damage possibility.

c) place tool on aircraft skin;
of foreign objects

d) run engines in presence in front of propellers

objects (stones, ice, gravel etc., which can damage propellers and enter air-intakes;

e) presence of people during test run of engines in front of propellers at a less than 10 m distance and in plane of propeller disc;

f) starting and test run of engines with a blaststream of propellers directed towards buildings, aircrafts etc, which are at a less than 150 m distance.

PREFLIGHT PREPARATION OF AIRCRAFT BY FLIGHT ENGINEER.

Before preflight preparation, check presence on the aircraft of aircraft airworthiness certificate, registration certificate, ^{Check} log books and certificates. With the aircraft and engine log books check conformity of the executed technical servicing with the quantity of hours flown by the aircraft.

PRELIMINARY PROCEDURES: 1. Check that fire protection cans are present in the vicinity of the aircraft, chocks are placed in front of the wheels of main gear struts, the aircraft is earthed, fuel sediment drained through drain cocks of tank groups.

2. Be sure that all covers and guards are removed from the aircraft except of air-intake guards which are removed immediately before starting engines.

3. In summer at ambient temperature +25° check that cabin is refrigerated by means of a ground conditioner.

4. In winter:

a) check for absence of ice, snow and frost on the aircraft surfaces, propellers, windows of the cockpit and passenger cabins

aileron hinges, flaps, control surfaces, tabs, external antennas, Pitot-tube static pressure orifices and course angle pick-up of astrocompass

b) check that cabins are heated to the +15 +20°C temperature by means of a ground conditioner;

c) at outside-air temperature below -30°C it is necessary before starting internal engines to warm hydraulic accumulators of basic hydraulic system and of brakes to a positive temperature.

INSPECTION AND CHECKING OF AIRCRAFT AND POWERPLANTS.

Carry out inspection and checking of aircraft in accordance with the plan indicated on fig.4.

NOSE PART OF FUSELAGE.

1. Inspect aircraft skin for damage (scratches, cracks, dents) and see that latches of radome are reliably locked.

2. Check housing of folded dipole antenna for condition; check beam antenna of HF communication set and antennae of radar and radionavigation equipment for condition.

3. Check mechanical indicator of nose gear strut position for condition.

4. Check cockpit windshields for cleanliness and condition; inspect exterior lights and their control for good operation; check lights for close fitting to the fuselage.

NOSE GEAR STRUT AND WELL

1. Open doors and secure actuator rods of doors with safety collars. Check for absence of oil leakage around hydraulic pipeline joints and around packings of shock absorber; be sure that contraction of shock absorber strut is 180-190 mm at aircraft all-up weight.

2. Be sure of absence of the side displacement of wheel tires relative the bead and of damages preventing possibility of

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Further operation of wheel tires; be sure that tire deflection is 25-35 mm. In case the deflation is above or below the above value, mentioned verify the tire pressure by means of a pressure gage. must
The pressure be $6 \pm 0,2 \text{ kg/cm}^2$.

3. Check feed-back cables of nose gear steering.
4. Check that bolt of rotatable yoke is screwed home and locked.
5. Check that attaching nuts of wheels are locked.
6. Check landing gear downlock for condition and cleanliness. Uplocks must be open and downlocks must be closed.
7. Check that rotatable cock of nose gear is in proper position. The latter is checked for absence of clearance between the cam on the landing gear uplock and the lever connected to the rod of rotatable cock. Check rod of rotatable cock for condition, inspect for bent rod.
8. Check for oil leakage around actuator rods of doors from hydraulic accumulators, hydraulic filter, distributor-damper P.M-I, electrovalves of the control of doors and landing gear, around jack rod of retraction and extension of nose gear.
9. Inspect wiring and disconnecting plugs. After inspection remove safety collars from actuator rods of doors and close the doors.

FUSELAGE PORT SIDE AND UN/PRESSURIZED COMPARTMENTS OF CENTER PLANE. 1. Check skin for damage (scratches, dents) and frames of entrance doors for condition.

2. Check accessories in unpressurized compartments of fuselage center plane and be sure that:

- a) there is no foreign objects in electrical compartment;
- b) accumulators and cabin pressurization and ventilation sets are reliably attached;

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c) turbocooler fan can be easily rotated by hand. After inspection close hatches.

3. Inspect housings of ADF antennae APK-5 #1 and 2, and of marker receiver 2 MPH-56M for condition.

POWER PLANT N 2. 1. Check that cowling covers are closed; be sure that covers are close fitted and all cowling latches are reliable, closed.

2. Check for fuel and oil leakages from the bottom of engine cowlings.

3. Check skin for damages and inspect for fuel leakage in fuel tank compartments.

4. Check outlets of the drainage pipes of fuel and oil systems; inspect drainage outlets for damages, dirt and icing.

5. Be sure that propellers can be easily rotated by hand; check blades and blade anti-icers for damages.

WARNING: Don't rotate propeller in counter rotation direction to avoid damages of ratched clutch of starter-generator CTF-12 TMO.

6. Check propeller spinner for absence of dents and be sure that the latch of detachable part is closed.

7. Check for absence of accidental discharge of internal power plant fire extinguishers.

LEFT MAIN GEAR STRUT AND MAIN GEAR COMPARTMENT. 1. Open doors and secure actuator rods of doors by safety collars. Check for oil leakage from packings of the rod of shock absorber strut and from pipeline joints of brake system and from wheel brakes.

2. Check ^{static} contraction of shock absorber strut by means of the indicator. Contraction must be within 360-380 mm according to aircraft all-up weight.

3. Check for cleanliness and absence of icing of bogie hinge attachments, mechanism of bogie folding, hydraulic pipelines and

lug of shock absorber strut used for latching with the uplock. Check for oil leakage from cylinders-dampers and for absence of cracks on attachment lugs. Inspect torque link for condition, for absence of cracks.

4. Check for absence of side displacement of wheel tires relative to bead and for damages preventing their further operation. Be sure that deflection of wheel tires is 65-75 mm. In case the deflection is above or below the above mentioned value inspect tire pressure by means a pressure gage. The pressure must be $2,0 \pm 0,2 \text{ kg/cm}^2$.

5. Check that attaching nuts of wheels are locked.

6. Check attachment of inertial sensing elements of anti-skid unit and their electrical wiring for condition.

7. Check landing gear downlock for condition and cleanliness. Uplocks must be open and downlocks closed.

8. Check that rotatable cock of main gear is in proper position. The latter is checked for absence of clearance between the cam on the landing gear uplock and the lever connected to the rod of the rotatable cock.

9. Check rod of this rotatable cock and control cables of engines, control cables of the latches of doors and of landing gear for condition.

10. Be sure of absence of oil leakage along jack rod of landing gear extension and retraction, from pipeline joints and hydraulic panel accessories, from hydraulic accumulators and along actuator rod of landing gear doors.

11. Be sure that pressure refuelling couplings are covered and locked.

12. Check for absence of fuel leakage from pipeline joints of fuel system.

13. Check details for cleanliness and springs of the uplock of

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landing gear strut ~~SECRET~~ in good working condition.

14. Check hatches for condition and verify that hatches are reliably closed.

15. Check wiring and disconnecting plugs for condition.

Remove safety collars from actuator rods of doors.

Close doors and be sure that latches are reliably closed.

POWERPLANT N 1. Carry out inspection and checking of power plant N 1 in the manner as for power plant N 2.

UPPER PART OF LEFT WING. 1. Check skin for condition. Be sure for absence of damages and of dirt, snow and ice on the skin.

2. Be sure that neck fillers are covered and locked and inspect that there is no fuel leakage on the upper panel of fuel tank N 3.

BOTTOM PART OF LEFT WING. 1. Check skin for condition and damages.

2. Be sure that all ^{latches} watch hatch are closed.

3. Check for absence of fuel leakage around the center plane, where fuel tanks and pumps are located, and also from integral tank N 4 in the detachable part of the wing.

4. Check fuel system drains for cleanliness and make sure of absence of fuel leakage through drains and sump drain tubes used for controlling a leakage through the packings of the transfer and boosting pump drives.

5. Check ailerons, static dischargers on them and flaps for condition and for absence of external damages.

6. Check wing leading lights and navigation lights for absence of damages and for cleanliness.

REAR TAIL SECTION. 1. Check skin for condition and be sure of absence of dents.

2. Check that the ^{latches} of the bottom tail hatch cover are closed.

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2. Be sure that the ^{latch} of the rear toilet hatch is closed and secured and check for absence of fluid leakages.

EMERGENCY. Check for skin damages.

FUSELAGE STARBOARD. Inspect the fuselage starboard in the same manner as the fuselage portside but in the reverse sequence.

IN ADDITION IT IS NECESSARY:

1. Inspect luggage compartments and check latches for good condition; see that cargoes are securely tied; be sure of presence of the freight retaining nets and verify attachments of caprone aprons to the floor of the luggage compartments.

2. Verify that the lock of the hatch for the connection of the ground conditioning unit and also the locks of the toilet hatch ^{latches} are closed.

3. Verify ^{airplane} receptacles of the ground power source for condition.

4. Check that the set of flares is complete.

PASSENGER SALOON, VESTIBULES, TOILETS.

1. Inspect passenger saloon, vestibules, toilets and be sure that:

- a) all compartments are clean, have not foreign objects and that the removable equipment is complete;
- b) passenger seats, luggage racks, wardrobes and equipment of the galley-pantry have no damage and are clean;
- c) window glasses have no damage, emergency doors are reliably closed and sealed;
- d) entrance doors have no damage, seal resin is in good condition, ^{latches} operate reliably;

e) portable oxygen sets are properly located, charged with oxygen (pressure in bottles not less than 30 kg/cm²), have hoses and masks in good condition;

f) fixed fire extinguishers are sealed and are properly located;

g) there is sufficient quantity of water in wash-stands and toilet fluid flushing tanks are filled with a chemical liquid.

2. Verify charging of the hydraulic reservoir. Check hydraulic fluid level after starting engines in accordance with markings "Hydraulic accumulators charged". or discharge all hydraulic accumulators and verify hydraulic fuel level in the reservoir in accordance with markings "Hydraulic accumulators discharged". It is not permitted to verify hydraulic fluid when the hydraulic accumulators are not fully charged.

COCKPIT. 1. Inspect cockpit to make sure of:

- compartment cleanliness and absence of foreign objects there;
- presence and properly location and attachment of all crew's equipment;
- cleanliness and absence of damages of the windscreens;
- close fitting of side window-panes;
- good condition of seats and safety belts.

2. Be sure that:

- two landing gear knobs are not pushed, knob of landing gear up position is reliably protected by a guard and the guard is secured with a stud;
- operating handle of emergency landing gear extension is in down up to the stop and is sealed;
- switch of anti-skid unit is turned on and is sealed;

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- switch of parking brakes is in the position "Braked";
- operating handle of emergency braking is not pushed and is sealed;
- switch of emergency braking off is in "off" position;
- button "Emergency parking brake off" is protected with a cap;
- mechanical indicator of nose gear is fully extended and is not bent;
- valves of the two windscreen wipers are closed and blades are in initial position (vertical).

3. During the cockpit inspection be sure that:

- aircraft instruments have not external damages, instrument pointers are in reference positions, pilot's, flight engineer's and navigator's instrument panels are reliably attached;
- barrels of the fuel flow meter PTMC are set in accordance with the quantity of loaded fuel.

N O T E: In order to set correctly the barrels of the total fuel consumption counter it is necessary to press the knob and turn it at first clockwise trying to get the same cipher on the all barrels and then to dial the nearest number exceeding the number to be set. At the same time it is necessary to make sure that the barrels are set correctly: all barrels must slightly oscillate while the rack is turned to left or to right at a small angle. Then turn the knob counter-clockwise till to obtain a required number on the barrels;

- fuel contents gauge is in the position for cabin.

4. Before switch electrical power source on make sure that all switches of the supply circuits to the consumers are turned off except for following switches; of fire syren, depressurization signalling, emergency wheel braking off, anti-skid unit and d.c. generators, which must be turned on.

5. Verify voltage of the onboard batteries 12 CAN-28 under a load 12a per every battery (the examination is accomplished before connecting the airfield power source to the aircraft).

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The voltage must be not less than 24v. Batteries with lower voltage must be changed.

6. Give to ground personnel instruction to connect the ground power supply source to the onboard electrical net.

NOTE: In case of absence of the ground power supply source take measures for economical use of the onboard batteries. For this purpose:

a) Do not permit to connect the consumers up except at emergency;

b) give instruction to the aircraft crew concerning economical use of electrical power;

c) do not make operating tests of aircraft special equipment;

7. Be sure that:

- all circuit breakers (ABC and ABP) on the radio operator's and navigator's central switch panel are out except for *NO-1500* inverter circuit breaker used as a switch of this inverter;

- red lamp "Nose gear steering" glows;

- indicator of landing gear position indicates "Landing gear extended";

- green lamps "Landing gear extended" glows;

- eight lamps of "d.c.generators" glows;

- three lamps of "a.c.generators" glows;

- indications of fuel contents gauge *COTC-280* on the dial of the total fuel contents and on the dial of the tank group fuel contents correspond to the quantity of loaded fuel;

- lamp "Doors open" glows;

- lamp "Air supply off" glows;

- lamp "excess temperature" glows;

- lamps "Minimum fuel pressure", "Minimum oil pressure"

- lamp "Flight controls locked", "Hatches open"

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- indications of oil contents gauge $W33-100$ correspond to the quantity of loaded oil in the oil reservoir of each engine;
 - heating of $TH-186$ Pilot-sub head is in good condition;
 - instruments $YH3-2$ (fuel control lever position indicator, three-pointer indicators of engine gauge unit $W33-100$, $W33-100$ (29MMV-100), cabin thermometer $TH-19$, thermometer $TH-20$, flap position indicator $YH3-47$ and landing gear position indicator $YH-48$ are in good operation condition (check according to the position of the pointers).

Be sure that pressure gauges of hydraulic system indicate following pressures:

"Emergency braking bottle"	100-150 kg/cm ²
"Emergency feathering bottle"	10-20 kg/cm ²
"Parking brake"	10-20 kg/cm ²
"Hydraulic accumulators of brakes"	not less than 50 kg/cm ²
"Hydraulic accumulators of basic system"	6-8 kg/cm ²
"Right brake" and "Left brake"	8 kg/cm ²

N O T E: In case the pressure on gauges "hydraulic accumulators of brakes" and "parking brake" is below the above mentioned values the flight engineer must start at first engine N 3. As in these conditions the aircraft is retained only by chocks placed in front of the landing gear before it is necessary while starting to be excessively cautious and take into consideration the possibility of aircraft movements or turning on the spot.

It is permitted to start subsequent engines only after the flight engineer makes sure that the pressure gauge "hydraulic accumulators of the basic system" and "hydraulic accumulators of brakes" indicate pressure not less than 100 kg/cm² and the pressure gauge "parking brake" indicates 10-20 kg/cm².

8. Check for operations:

- electrical mechanisms of the doors of oil coolers;
- electrical mechanisms of the trim tabs and of their neutral position signalling;
- fuel pumps and their signalling;
- fuel shut-off cocks;
- fuel cross-feed valves; cut circuit breakers and window glass heater in; inspect cutting in and cutting off of the window heater with the ammeter of onboard network. The presence of the current corresponds to the heater's cutting in and the absence of the current corresponds to the heater's cutting off. Determine glass heating to the touch after no-two-cycles.

9. Check the cockpit lighting and all warning lights.
10. After the aircraft is loaded, get sure that cargo is securely lashed, close hatches and doors and report the captain on being ready to start engines.
11. Start the engine.
12. Switch off master starting switch.
13. With engines running, get sure that pressure in hydraulic accumulators is in the limits of 225-148 kg./cm².
14. After testing the engines and other systems operation, remove locking pins with streamers out of the landing gear "Down" locks.

NAVIGATOR'S PRE-FLIGHT PREPARATIONS

1. Carry out external inspection of the ADFs antennae, radome and glass cap of **AAK-15-5** astrocompass and astro tracker.
2. Examine and prepare for flight the cockpit and the navigator's station:
 - a) Check to see that the proper set of navigation and radio navigation equipment is installed in the cockpit; examine the instruments for good condition and security of attachment; be sure that the **AF-5** ADF, **KM-13** compass and the compass system deviation cards, the altimeters and speed indicators correction cards, and the **Manac (AKB)** or its perforated sheet for the flying day are available;
 - b) Check the navigator's seat for condition;
 - c) Check the clocks winding and set the exact time on all the clocks in the cockpit;
 - d) Set the latitude of the point of departure on the compass system control panel (**EMK-52** directional gyro); set on the dials of the **AAK-15** astrocompass computer the sun coordinates for a given moment (magnetic variation Greenwich hour angle).

and geographical coordinates of the aircraft parking place (latitude and longitude) and press the "Winding" button on the computer front panel 4-5 times. Set the above coordinates only with DC and AC supply of the ~~HAH-15-5~~ astrocompass on;

e) Set the magnetic variation index at zero on the Navigator's indicator and the KM-4 correcting mechanism;

f) Set the altimeter pointers at zero and compare the barometric scale readings with the barometric pressure given by the meteorological station. Difference in readings should not exceed 1.5 mm.Hg.;

g) Make sure that the THB-15 thermometer indicates the ambient air temperature;

h) Check that the head phones, throat microphones and oxygen mask are available.

3. Prepare the compass system for flight;

a) be sure that external power is connected and check its voltage by the voltmeter;

b) switch on the HT-1000M and HA-1000 inverters and make sure that all the ABC and ALP circuit breakers on the navigator's switch panel are on;

c) check that the AH-6E autopilot is energized by turning the switch on the co-pilot's roof switch panel and synchronise the main and auxiliary master vertical gyres;

d) five minutes after the compass system is switched on, set the compass system function selector switch in the "Magnetic Correction" position and synchronise it (by the quick synchronizing button) on the main and auxiliary gyre units;

e) check the course readings of the Navigator's indicator, YR-I and YTA-IV indicators, ("pointer") and the direction indicator of HA-50EM, ground position indicator and compare these readings with the HA-13 compass reading (taking into account its deviation on the ground).

The course readings of the YK-I and YIA indicators and the direction indicator of the HM-500M ground position indicator must not differ from the Navigator's indicator readings by more than their division value, i.e. $\pm 2^\circ$.

NOTE: At an ambient air temperature not exceeding -10° switch off the compass system and autopilot power supply fifteen minutes before take-off. At a temperature from -10° to 20°C switch on the above instruments and the AK-55 astrocompass twenty minutes before take-off and at a temperature below -30°C thirty minutes before take-off. When the ambient air temperature is below -20°C , the "Autopilot Heat" should be switched on one hour before take-off.

f) tune the ADFs to the departure airport radio beacons, No. 1 - to the distant radio beacon and No. 2 - to the exit corridor radio beacon), check the remote control units for proper operation and make sure that frequencies on the tuning dial and the radio station relative bearings are measured correctly.

g) 15 minutes after the compass system is switched on, check its operation in the directional gyro readings on the main and auxiliary gyro units and by connecting the attitude indicator to the main and auxiliary master vertical axes make sure that they reliably operate and are synchronized.

4. Preparation of astrocompass for flight:

a) connect the compass DC and AC power supply by setting the "Power" switch on the computer front panel in the upper position.

NOTE: In winter, when the temperature inside the compass is $10-15^\circ\text{C}$ below zero, the red "Warning - UP" warning light on the computer front panel comes on indicating that the compass is not ready for operation.

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Further use of the compass is allowed only after warming it up; in this case the warning light goes out.

b) check to see that the sun coordinates for a given moment (magnetic variation and Greenwich hour angle) and departure airport geographical coordinates (latitude and longitude) are set on the computer dial;

c) set the "Speed" and "Track" pointers at zero on the track corrector;

d) set the "AW-CR" (astro tracker - sextant) switch on the computer front panel in the "AW" position.

5. Check the astrocompass for reliable operation. If it operates reliably, after performing the operations specified in paragraph 4 and with the sun visible:

a) the course indicators pointers should not change their positions indicating the true course of the aircraft;

b) by pressing the "AW Check" button (this button has another inscription "Winding") the course indicator pointers should start rotating and after releasing the button, the pointers should return to their previous readings of the true course;

c) when the sun is not visible the course indicator pointers should be in any position, with the "AW Check" button pressed the pointers should rotate and with the button released they will stop in any position on the course indicator dial;

d) the yellow "Check" warning light on the computer front panel should be on indicating the check reliable operation; the previously set readings of Greenwich hour angle should change depending on the instrument operating time;

e) with the astrocompass operating in conjunction with the compass system, set the compass system in the "Compass system" position and the compass system direction - reflector switch in the "Astro Correction" position.

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In this case the true course (celestial course) is indicated on the Navigator's indicator and on its repeaters VK-I indicator and on the direction indicator of the RH-50BM ground position indicator. Maximum error of the RAK-AB-5 astrocompass is not more than $\pm 2^\circ$.

6. After 15 minutes synchronize the readings of the THK-52 directional gyro and those of the Navigator's indicator.

7. Switch on and check the operation of the radar according to its flight operation instruction.

8. Check UVL lights and white lights, place them in the proper positions and check the instrument dial lighting.

9. Before starting the engine cut out power supply of the flight-navigation and radio navigation equipment.

10. After the engine starting connect the power supply of the flight-navigation and radio navigation equipment. Check that the RH-1000M inverter is switched on and the autopilot is energized.

11. 5 minutes after switching on the compass system, set its function-selector switch in the "Magnetic Correction" position and synchronize the operation of the main and auxiliary gyro units.

12. Switch on both the APK-5 ADFs and tune the APK-5 ADF No.1 to the departure airport radio beacon and the APK-5 ADF No.2 to the exit corridor beacon and check them for proper operation.

13. 15 minutes after switching on the compass system check its operation in the directional gyro regime and also check the main and auxiliary master vertical gyros synchronized operation by switching them in turn.

14. Check the K-275 barospeedograph charging in the presence of a specialist.

15. Report the captain that the Navigator's equipment is checked and the aircraft is ready for taxiing to the flight line.

CO-PILOT'S PRE-FLIGHT PREPARATIONS

1. Take on board freight, mail, baggage, covering list and cargo papers. Watch the process of loading, stowage and fastening of cargo in aircraft and watch how the passengers get on board. Check the aircraft C.G. position and take-off weight.
2. Examine your station. Fit your seat and pedals according to your height.
3. Examine and check your equipment for proper operation.
4. Check the correctness of the instrument initial readings on co-pilot's instrument panel and on starboard console.
5. Check position of "Emergency Stations". Ensure that the valve is set in the "Main" position and locked.
6. After starting the engines energize the autopilot, switch ON the servo units heating compass system power supply.
7. Set up dial of the YHK directional gyro indicator according to the readings of the YK-I indicator.
8. Check charging of the aircraft oxygen bottles. The oxygen pressure in the bottles should be not less than 30 kg./cm².
9. Check the KI-32 oxygen regulator pressure gauges and oxygen indicator caps for damage. Ensure that the oxygen masks are serviceable and are in their places.
10. Check your station and instruments for proper illumination.
11. Check the wing landing lights and navigation lights for operation (at night).
12. Ensure that all the warning lights at your station are serviceable.

RADIO OPERATOR'S PRE-FLIGHT PREPARATIONS

1. When inspecting the radio equipment visually ensure that:

- a) antenna devices located outside of the fuselage are in good condition;
- b) panels, control panels, housings and front panels of radio units and instruments are not damaged and attached securely;
- c) ADF and YC-8 receiver remote control mechanisms are turned easily and smoothly;
- d) fuses installed in the units are attached securely;
- e) fuses installed on the A.C. switch panel are attached securely;
- f) antenna wiring is correctly and securely connected to partition insulators and units;
- g) headphones and throat microphones of all crew members are in good condition;
- h) sealed cases with spare radio valves and fuses and transmitter tuning charts for PCS-5 and PCS-70 radio sets are available.

2. Ensure that the aircraft electrical system is supplied from the external power supply cart and has a voltage of 28.5 V. After this check the radio equipment operation with voltage applied the radio equipment remote control devices for correct functioning and the lights mounted in your station for condition.

3. Ensure that all circuit breakers (ABC and ABP) except NO-1500 inverter circuit breaker on the radio operator's switch panel are switched ON. Ensure that the spare bulbs and fuses are available.

4. Check main and standby HT-1000H inverters for operation with load connected.

The voltage should be 34-38 V. As additional load connect the compass system.

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When the standby inverter is ON, the control panel comes on.

5. Check the DC inverter for voltage applied. The voltage should be 115 V. in the ADFs.

6. Before starting the engines from the control panel, the radio operator must ensure that both AC power sources are ON, (two green lights on the DE control panel are illuminated).

7. When starting the engines, radio operator checks voltmeter readings on DC control panel.

WARNING: If voltage at fifth stage of engine starting cycle (after 30 sec.) drops continuously and becomes lower than 45V give the command "Stop cranking".

8. After all engines are started, radio operator must do the following:

- switch OFF the external power and switch ON the aircraft batteries; to do this, set the "Ext. power batteries" selector switch in "Battery" position. The aircraft electrical system voltage with all 8 generators and batteries connected in parallel should be 28.5 V.

- switch ON the main alternators and check their operation; check standby XO - alternator operation by connecting it in lead of any of the main alternators. The voltage across each alternator terminals should be 115 V.

STEWARDESS'S PRE-FLIGHT PREPARATIONS

When preparing the aircraft for flight the stewardess must:

1. Examine the passenger cabin for cleanliness and absence of foreign objects, make sure that provided area carpets and curtains, hangers for the passengers' outer garments, and in the first

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aid kits of the passenger cabin and the cockpit, a set of portable oxygen bottles with hoses and gas masks, fire extinguishers with seals.

2. Check that the seats are provided with head restraints and the cushions - with pillow filling.

3. Be sure that the cabin is heated to 15-20°C from the airport heater in winter and is cooled in summer.

4. Inspect the galley/pantry for cleanliness, absence of foreign objects and its equipment for good condition.

5. Take on board containers with food.

Make sure that:

a) containers with food, bottles, fruit and linen are placed into the appropriate recesses in the galley shelves and counter and properly secured by locks.

NOTE: The keys from the locks should be kept in a drawer of the galley/pantry front counter.

b) containers for second course dishes are placed in the recesses of galley/pantry starboard shelves and secured in them;

c) electric coffee pots and electric thermoses are placed into the recesses and secured in them;

d) drain holes plugs of the thermoses should be firmly unscrewed.

6. With the external power supply ON, check that the electric boilers are connected to the circuit by switching them on in turn. Slight blinking of the galley/pantry light, with the electric boilers switched on, indicates that the contact is proper and the boilers are reliably connected.

Check the electric oven by setting the switch at 100 deg. and 200 deg. in turn. The warning light illumination indicates the reliable operation of the oven.

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NOTE: Set the "Galley Energized" switch on the stewardess's panel in the upper position before switching on the galley/pantry power consumers.

WARNING: When the external power is not connected and the engines do not run the stewardess is allowed to switch on only the dim lighting, domestic compartments lighting and stewardess call.

7. Check the telephone communication of the stewardess with the crew members.

8. Inspect the wardrobes and vestibules for cleanliness and absence of foreign objects.

9. Inspect the toilets for cleanliness and absence of foreign objects. Make sure that the toilets are provided with trash containers, paper cloths, towels, soap, brushes; examine the closets, trash containers, wash-stands, mirrors, walls and floor of the toilets for cleanliness.

10. Check the closets for proper operation by pressing the closet slushing pedals. With the pedal pressed, the closet seat rises from the lower to the extreme upper position and chemical fluid should pass through the upper slushing ring. With the pedal released, chemical liquid supply is stopped.

11. Check the wash-stands operation and hot and cold water supply. Switch on the "Galley Energized" switch, "Front Toilet Water Heat", "Rear Toilet Water Heat" and "Toilets Water Heat" A/C circuit breakers on the stewardess's panel. In 1-2 minutes check the hot water supply to the wash-stands and note as follows:

- set the selector valve in the "Hot" position;
- press the hot water tap. Hot water should flow;
- set the selector valve in the "Cold" position;
- press the cold water tap. Cold water should flow.

After that switch off the "Galley Energized" A/C circuit breaker on the stewardess's panel.

12. Before passengers' boarding switch on the "Dim Lighting", "Domestic Compartments Lighting", and "Stewardess Call" A/C circuit breakers on the stewardess's panel.

13. At night, with the external power supply connected, switch on the A/C circuit breakers of the main and auxiliary lighting, before passengers' boarding.

CAPTAIN'S PRE-FLIGHT PREPARATIONS

The captain should receive reports from the flight engineer, radio operator, co-pilot and stewardess that the aircraft and its equipment is ready for flight. Then he should personally inspect the aircraft in the same sequence as the flight engineer does.

At the same time the captain must do the following:

AIRFRAME AND POWER PLANTS

Inspect the fuselage, wing, tail unit and power plants; make sure that on external surfaces of aircraft elements there are no damages and no leaks of fuel and oil. Make sure that access doors and covers of the fuselage and engine nacelles as well as coolings are closed, the ailerons, flaps, rudder, elevator, trim tabs, Pitot tubes, landing and taxi lights and antennae have no external damages and the static holes plugs and Pitot tubes covers are removed.

In winter be sure that snow, hoar-frost and ice are removed from the aircraft surfaces, cabin windows and Pitot tubes.

LANDING GEAR Make sure that air pressure in the tires is normal, the tires have no defects and no shifting relative to the wheel flanges, the landing gear doors are closed, the shock struts have normal extension and are sealed, locking pins with streamers are secured, the L.S. gear locks.

PASSENGER AND CARGO PREPARATIONS

Receive the co-pilot's report from passengers, cargo and mail.

are on board and the aircraft's actual take-off weight is balanced.

COCKPIT. 1. Inspect the cockpit and ensure that window glasses are clean and are not damaged. Fit your seat and pedals according to your height.

2. Check the instruments installed on pilots' instrument board and on the port console for initial correct readings.

3. After switching ON the external power supply, check:

- a) AHS-2 and AHS-IC artificial horizons for accuracy;
- b) warning lights at your stations for serviceability;
- c) before night flights the fuselage landing lights for proper operation and the lighting of your station for condition;
- d) the autopilot operation in accordance with the autopilot operation instructions (chapter VI e.).

4. Be sure that the trim tabs of the elevator, ailerons and rudder/set in neutral position: the elevator trim tabs - by the hand wheel scale, the aileron and rudder trim tabs - by illumination of the green lights installed near the switches.

5. Check the landing gear warning system and be sure that all green lights are ON.

6. Receive the report from the crew members that the engines are ready for starting. Switch ON the nose gear steering. Start the engines and together with other crew members make sure that the systems inspected after the engine starting operate reliably and check the engine instruments for correct reading.

7. Give a command to the ground personnel to disconnect the external power supply, to take away the chocks from the main L.G. wheels and ask a permission for taxiing.

8. Unlock the rudder, elevator and ailerons. The red light "Control Surfaces Locked" must go out and the green lights "Control Surfaces Unlocked" come ON. After that the navigator should switch off the circuit breaker of the control surfaces locking system. In this case the "Control Surfaces Unlocked" and the locking system

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circuit breaker ON position warning lights must go out. Check the controls for proper deflection.

6. ENGINE STARTING, WARMING UP AND GROUND TESTING INSTRUCTIONS

PREPARATION FOR ENGINE STARTING

1. The engines are started from the aircraft or external power supply sources.

2. Before starting the engines be sure that the shields for the engine air intakes, jet pipes and oil cooler ducts and plugs for the static holes are removed; that around the wheels of the main L.G. bogies there are placed chocks linked by rods at each bogie; that the place under propellers is clear; that near the aircraft there are no foreign objects, which may cause damage to the aircraft in the event of its inadvertent turns, especially in winter; that the ground personnel is ready for starting the engines and they have occupied their places (in the view of a person who starts the engines in cockpit); that near the aircraft there are fire extinguishing means; that the parking brakes are ON; that there are no chocks under the wheels of the nose gear and that the nose gear steering control is switched ON.

3. Before starting the engines be sure that the power supply sources are connected to the aircraft electrical system and the system voltage does not exceed 28-29 V (with the external power supply) and is not below 24 V with the system supplied from the aircraft power supply sources;

- that all unnecessary consumers are switched OFF;
- that all the circuit breakers (ACB and DCB) on the navigator's and radio operator's control panels are switched on;
- that the engine fuel shut-off valves are opened;

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- that the propellers are lubricated (red warning lights are OFF);
 - that the propellers blade stops are released (four upper red lights are ON);
 - that the "Min. Fuel Pressure", "Min. Oil Pressure", "Booster Pump Fail" light signs must go out;
 - that the engine oil pressure cut out (two red warning lights are ON);
 - that the selector switches of the oil engine shutters control are in the "Automatic" position;
 - that the engine stop selector switches are in the "Operating Position";
 - that the engine master lever are against the ground (idle stop (0) by a master lever position indicator);
 - that the "Cold rotation" selector switch is turned OFF.
4. Switch on the booster pumps and make sure that the fuel pressure downstream the booster pumps is normal (the "Min. Fuel Pressure" and "Booster Pump Fail" light signs must go out when booster pumps are switched on).
5. Set the engine starting master switch in "ON" position.
6. Give a command "Clear off the engines" and a command about a succession of the engines starting. Having received a reply from the ground personnel, proceed to starting.

7. STARTING THE ENGINES

Set the engine selector switch in the position corresponding to the engine to be started.

8. Press and in 1-2 sec. release the starting button and simultaneously start a stop-watch. After pressing the starting button the automatic starting system begins operating, the "Starting ON" green light comes ON and engine should gain the idle speed for not more than 120 sec.

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If during the engine starting the exhaust gas temperature tends to exceed 750°C , it is necessary by pressing the fuel by-pass button to lower the exhaust gas temperature down to $650\text{--}700^{\circ}\text{C}$ and then release the button.

NOTE: In case of intensive increase in the exhaust gas temperature at the beginning of engine starting, it is recommended to make a preliminary fuel by-pass not waiting till the exhaust gas temperature reaches 750°C . For this purpose, when the exhaust gas temperature reaches $300\text{--}400^{\circ}\text{C}$, it is necessary to press the fuel by-pass button and hold it until the exhaust gas temperature stops rising rapidly not preventing the increase in r.p.m. After the exhaust gas temperature stops increasing, release the by-pass button. Then use the fuel by-pass button as described above. If when using the fuel by-pass button the exhaust gas temperature tends to exceed 750°C , stop starting the engine.

9. The process of the engine gaining the idle speed after pressing the engine starting button is as follows:

- a) put into operation are the starter-generators supplied through the starting resistors, which provide a low starting current, and the starting ignitor plugs begin operating;
- b) at the fourth second the starting resistors are shunted and the starter-generators are switched ON to the 24 V aircraft electrical system directly;
- c) at the ninth second the PYT-600 power regulators of the starter-generators are switched ON and starting fuel is fed off;
- d) at the fifteenth second the PYT-600 power regulators are switched OFF and the starter-generators are automatically changed for the 48 V power supply.

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e) at the twentieth second the starter-generators are switched OFF again, the engine starts rotating and the KTA fuel control unit begins to supply the operating fuel needles;

f) at the twenty-fifth second the starter-generators are switched OFF and the starting fuel is stopped;

If the operating fuel does not start flowing into the engine;

g) when the engine gains 35-50% r.p.m. (4.700-6.400 r.p.m.) for less than 70 sec. after the beginning of starting the engine, the starter-generators are switched OFF by the

B3-2C hydraulic pressure switch.

If the starter-generators are not switched OFF before reaching 50% r.p.m. (6.400 r.p.m.) switch them OFF by the "Starters OFF" button. If the starter-generators are not switched OFF by the B3-2C hydraulic pressure switch for a period up to 70 sec. after the beginning of starting the engine, they are automatically switched OFF by the engine generator.

10. At 70-74% of the engine r.p.m. (9.800-10.200 r.p.m.) the air relief valves behind VIII stage of the compressor are closed.

Within a period of 120 sec. from the beginning of starting, the engine gains the idle speed 79.5-82.5% (6.400-6.800 r.p.m.).

At idle rating, oil pressure should not be less than 4.0 kg./cm.²

When the engines gain idle speed, four lower red lights come on (pressure increase in low pitch line); in this case all eight red lights are on (propellers pitch stops released) and warning lights in KKL-37 feathering buttons go on.

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WARNING:**SECRET** Engine starting

- a) If starter-generators are out out untimely;
- b) If exhaust gas temperature, when fuel by-pass button is used, tends to exceed 750°C ;
- c) if stabilized voltage drops below 16 V during starting;
- d) if the engine does not gain idle-speed in 120 sec. after pressing the starting button;
- e) if fuel does not ignite in 25 sec. (there is no exhaust gas temperature indication).

To stop starting it is necessary to set the engine cut-out switch in the "Engine starting" position and to cut out the starter-generators.

WARNING:

Don't repeat starting until clearing up the reasons of starting failure.

11. After a failed starting, when the engine was fed with fuel and ignition didn't take place, make next starting only after blowing the engine off by cold rotation from the starter-generators.

It is allowed to make five successive startings of the same engine with not less than three minutes intervals between startings.

After the fifth starting it is necessary to make 20-min. interval to cool the starter-generators.

In total it is allowed to make up to five startings following each other or not more than eight startings with 3-min. intervals between them. After that a 15-min. interval should be made for cooling the equipment and then it is allowed to repeat the starting cycle.

To perform cold rotation of the engine, set the switch in the "Cold Rotation" position.

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- set the master starting switch in "ON" position;
- set the engine output switch in the "Engine running" position;
- move the engine power control lever to ground idle position;
- set the engines selector switch for the engine which is under cold rotation.

Give a signal warning about the engine rotation and press the "Engine Start" button.

After pressing the "Engine Start" button, starter-generators accelerate the engine up to 14-16 % of full speed and are automatically cut out in 30-35 sec. After it is necessary to cut out starter-generators untimely, press the "Starter Stop" button.

12. After starting the engine there should be not less than 45 litres of oil in the oil tank. Before starting there should be 32 litres of oil in the tank.

NOTE: All waste oil from the tank into the running engine (on the ground as well as in flight) should not exceed 17 litres for engines of the second and third series and 12 litres for the first series.

13. To start the next engine, set the selector switch for this engine position and make starting as described above.

It is allowed to start the next engine when the previously started engine has gained ground idle speed.

14. After all the engines are started, switch on all the CTP-12TMO generators and CTP-8 alternators to check the operation and functioning of the aircraft equipment, check operation of the PTMC flowmeters and the readings at all engine ratings.

WARMING-UP AND TESTING THE ENGINES ON THE GROUND

Warm up and ground test the engine in accordance with the schedule and proceed as follows:

1-2. Start and warm up the engine at ground idle rating until the engine inlet oil temperature reaches $+20^{\circ}\text{C}$.

3. To warm up the oil in the propeller hub, change twice the engine rating from idle to 0.6 normal rating ($90 \pm 2^{\circ}$ by the fuel control lever position indicator).

4. Check the operation of the propeller pitch hydraulic stop as follows:

a) run the engine at 0.6 normal rating ($90 \pm 2^{\circ}$ by the fuel control lever position indicator);

b) set the propeller pitch stop control switch in the "Propeller Pitch Stop ON" position; two lights on the pilot's instrument panel go out: upper light goes out due to oil pressure increase in the pitch lock line and lower light goes out due to pressure decrease in the low pitch line.

WARNING: With the engine running on the ground, do not retard the engine power control lever to idle stop (0° by the fuel control lever position indicator) until the propeller pitch stop is released.

c) smoothly retard the power control lever until the engine speed falls from 95-96% (12,000 $\pm$ 90 f.p.m.) to 93% (11,000 f.p.m.) and after that set the control switch of the propeller pitch stop in the "Stop Released" position. Pitch lock and low pitch lights come on. The engine r.p.m. must recover to initial r.p.m. i.e., to 95-96% (12,000 $\pm$ 90 r.p.m.).

5. Check the propeller feathering system by the immediate feathering control button as follows:

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a) run the engine at 0.6 normal rating ($50 \pm 2^\circ$ by fuel control lever position indicator);

b) set the propeller pitch stop control switch in the "Propeller pitch stop ON" position; the warning lights "Propeller Pitch Stop Released" should go out;

c) momentarily (for 1-1.5 sec.) press the incomplete feathering control button; the engine speed must decrease by 1.5-2.5% (200-300 r.p.m.); after releasing the button the engine speed must recover; with the button pressed, the green warning light indicating the feathering pump operation is on;

d) set the propeller pitch stop control switch in the "Stop Released" position; pitch lock and low pitch lights must come on.

6. Check the automatic feathering system by torque meter as follows:

- run the engine at a rating above 0.7 normal (approx. 64° by fuel control lever position indicator);

- set the propeller pitch stop control switch in the "Propeller Pitch Stop ON" position;

- turn on the switch to test the automatic feathering system by the torque meter;

- retard the engine power control lever to idle stop (0° by fuel control lever position indicator).

The reliable operation of the automatic feathering system actuated by torque pressure is checked by appearing of the feathering-button light controlled by the automatic feathering transmitters actuation, and by the feathering pump operation green light near the button

After the expiration of 20 sec. **AMI-4** timer will switch off the feathering pump and the warning lights will go out.

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NOTE: It is recommended to shorten the pump operation cycle by momentarily pulling out the ~~KAL-37~~ feathering buttons. Warning light in the ~~KAL-37~~ feathering button will go out.

- turn off the switch controlling the test of the automatic feathering system by the torque meter;

- set the propeller pitch stop control switch in the "Stop, Released" position;

7. Check the negative thrust rise warning system as follows:
 - run the engine at the ground idle rating (0°b; fuel control lever position indicator);

- set the propeller pitch stop control switch in the "Pitch Stop ON" position;

- press the switch of the automatic feathering system test by negative thrust.

Reliable operation of the automatic feathering transmitter actuated by negative thrust is checked by comparing of the warning light in the ~~KAL-37~~ feathering button and the green warning light indicating the feathering pump operation;

- release the test switch of the automatic feathering transmitter actuated by negative thrust.

8. To test the engine operation at all ratings:

- set the propeller pitch stop control switch in the "Propeller Pitch Stop ON" position and smoothly move the engine power control lever to normal rating position, for a short time (for 10-15 sec.) run the engine at this rating to check the instrument readings and then accelerate the engine to take-off rating and check the instrument readings again.

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Instrument readings, indicating normal engine operation at normal and take-off ratings during the engine ground test:

	Normal rating	Take-off rating
Fuel control lever position ind., deg.	82-85	98-105
Engine r.p.m., %	95-96	95-96
Oil pressure, kg./cm. ² ^{x)}	3-3.5	3-3.5
Exhaust gas temp., °C	not above 525	not above 520
Eng. inlet oil temp., °C	40-60	40-80
Fuel pressure, kg./cm. ²	not above 82	not above 78
Torque, kg./cm. ²	60-65	75-80

x), 4-4.5 kg./cm.² for engines series 1.

9. To test the engine acceleration:

a) set the propeller pitch stop control switch in the "Pitch Stop ON" position;

b) during 1.5-2 sec. move the engine power control lever from "Ground Idle" to take-off position.

NOTE: Time required for the engine acceleration should not exceed 15 sec. When testing the engine acceleration in hot weather conditions, attentively listen to the engine noise if there is any surge.

c) set the propeller pitch stop control switch in the "Pitch Stop Released" position;

d) run the engine at take-off rating for 20-30 sec. and for 1.5-2 sec. retard the engine power control lever in the "Ground Idle" position.

The engine should smoothly pass to idle rating during 7-11 sec.

10. After the engine operation test is accomplished it is necessary to cool the engine at idle rating during 2-3 minutes.

11. Check the aircraft electrical system voltage which should be not less than 24 V.

12. Stop the engine by setting the engine cut-out switch in the "Engine stopping" position, close the shut-off valve and measure the engine run-out time from 82 speed (1070 r.p.m.) to full stop. The run-out time should be not less than 60 sec.

After the engine is stopped, set the engine cut-out switch in the operating position, set the propeller pitch stop control switch in the "Propeller pitch stop On" position and close the fuel shut-off valve.

WARNING: Until the engine is stopped fully:

- a) do not set the engine cut-out switch in the operating position;
- b) do not de-energize the aircraft electrical system.

NOTE:

In emergency, the engine may be stopped at any rating, but after such stopping (without preliminary cooling) test the engine rotor for easy rotation by turning the propeller in the direction of normal rotation. If the rotor is stiff to rotate, it is permitted to start the engine again only after the engine is cooled and free rotation of the rotor is obtained.

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CHAPTER 111

F L I G H T

SECRET**-57-****1. PRE-TAXIING DUTIES**

Check the readiness of the aircraft according to the chart of compulsory checks.

WARNING: The IL-18 airliner can be normally operated from airfields with runway length of not less than 1,800m.

2. TAXIING

1. Check that the steering of the nose undercarriage is on.
2. Ensure that the propeller stop switches are set at "Stop removed" (eight red warning lights are illuminated).

3. Unhook the wheel parking brake and check the pressure gauges for pressure in the primary brakes; increase power of the engines to give the aircraft a smooth roll. After the aircraft starts moving, change power in proportion with a taxiing speed and apply the brakes, if necessary.

- WARNING:**
1. Taxiing is prohibited on concrete and unpaved runways scattered with stones, dirt, ice and other foreign objects.
 2. During taxiing it is prohibited to set the engine power at 5-15 deg of the fuel control lever position indicator because this leads to closing of the compressor air by-pass valves. Periodic opening and closing of these valves may lead to an engine surge.
 3. Engine oil inlet temperature in taxiing at 0.2 of nominal power and below, with fully opened oil cooler shutters, should not exceed 100°C. In particular cases, it is permitted to run an engine for a period of no more than 15 minutes at oil inlet temperature of 100°C and to start take-off.
 4. Continuous run of an engine at Idling should not exceed 30 minutes on the runway before take-off and during taxiing.

In taxiing on unpaved runways, use the outboard engines in the main.

4. Apply the nose wheel steering to turn in taxiing. If necessary, apply the wheel brakes and outboard engines. It is not recommended to leave the nose wheel turned to extreme angles during stops in taxiing.

5. Before taxiing out for start, extend the flaps by 15-30 deg, depending on the take-off conditions, and remove the safety pin

of the undercarriage lock.

WARNING: It is prohibited to turn the aircraft on the immovable bogie wheels at the turning circle radius more than the wing span.

Min. permissible turning radius changes with speed in the following way:

Aircraft speed, km.p.h.	30	40
Min. permissible radius, m	17	12

3. PREPARATION FOR TAKE-OFF

1. Taxi to the runway and put the aircraft in the direction of take-off. For this purpose taxi for 30 seconds in the take-off direction and ensure that the aircraft is now in the right position. Switch on the barometric altimeter by turning down the lever on the front panel. The altimeter is set by the navigator.

2. Check the aircraft for readiness according to the Pre-flight Checks Chart.

3. Brake the undercarriage wheels.

4. Check the operation of the engine control lever. For this purpose, proceed as follows:

a) With the propellers in the position of maximum pitch, gradually move the engine control lever to the position corresponding to 50-55 deg on the fuel control lever position indicator, then suddenly set them at 10 deg. When the fuel control lever position indicator shows that the fuel control lever position is at which readings of the fuel control lever position indicator the r.p.m. fall to 93 percent.

b) Set the engine ratings at 50-55 deg on the fuel control lever position indicator.

c) Set the master stop switch at "STOP". This must switch off the warning lights on the pilot's instrument panel.

d) Smoothly return the control levers of two till engine r.p.m. fall from 95-96 percent to 90 percent. Take notice of the readings of the fuel control lever position indicator.

e) Readings of the fuel control lever position indicator, at which the engine r.p.m. fall to 90 percent, must be higher with the propeller blades on the stop, than with the propeller stop removed.

f) After the check, set the engine levers to increase rating up to balanced r.p.m., the propeller stop switches remain at "the stop is on".

3. IT IS PROHIBITED TO TAKE-OFF AND FLY WITH THE PROPELLER STOPS REMOVED AS WELL AS WITH ILLUMINATED WARNING LIGHTS, INFORMING ABOUT PRESSURE FALL IN THE PITCH CONTROLLER LINE OR ABOUT PRESSURE RISE IN THE FINE-PITCH LINE.

5. Deflect the elevator trim-tab by 1-1.5 deg (in pitch-up position). Having received the permission to take-off, the captain commands to start take-off.

4. TAKE-OFF

ATTENTION! In the event of a failure of the turboprop engine or propeller control system in flight, a dangerously high propeller drag may build up, resulting in a dangerous situation if the flight crew fails to take correct actions in due time.

Therefore, the flight crew must all the time keep close observation on the behavior of the aircraft and on the instruments controlling operation of the engines. On appearing of some indications of engine failure (See Chapter 3, Section 1), feather immediately the propeller of the failed engine according to the instructions in Chapter 3.

1. While restraining the aircraft by the brakes, set smoothly the control levers of two outer engines at take-off rating. The flight engineer shall report to the captain that the outer engines are at take-off rating.

2. Set the control levers of two inner engines at take-off

rating, the flight engineer shall report to the captain that the engines are at take-off rating.

Remove the brakes smoothly.

3. Maintain the take-off direction by steering the nose wheel in the first phase of take-off roll and by applying the rudder as speed increases. Switch off the nose wheel steering at a speed of no more than 130-140 km.p.h. If necessary (side wind, etc), it is permitted to apply the nose wheel steering up to a higher speed.

4. On achieving a speed of 180-190 km.p.h., smoothly pull the control column backwards to unload the nose wheel and "tear it off" the ground at a speed of 190-200 km.p.h.

5. Unstick with unmodified aileron control system at a speed of 230-235 km.p.h., at any T.O.W. If the aircraft has a modified aileron control system, unstick at the following speeds, depending on TOW:

Table 8

T.O.W., tonnes	61	59-58	56-54	52-50	48
Unstick speed, C.B.S., km.p.h.	235	230	220	215	210

6. Retract the undercarriage at a speed of 250 km.p.h. (at a height of not less than 5 metres).

7. After clearing the obstacles at an altitude of not less than 50 metres, retract the flaps, at a speed of not higher than 300 km.p.h.

8. Rise CAS up to 380-390 km.p.h. and continue climb.

9. At an altitude of not less than 100 metres, set the engines at nominal rating and trim the aircraft.

10. Make the first turn at a speed of 380-390 km.p.h. and at

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an altitude of not less than 200 metres.

Switch on the air conditioning and pressurization system.

5. TAKE-OFF WITH SIDE-WIND

Permissible side wind velocity (at an angle of 90 deg. to the runway) at take-off is not more than 15 metres per second.

In run, do apply the nose wheel steering.

Do not retract the nose wheel till the aircraft flying on course becomes steady.

Counteract the drift after unsticking by changing the aircraft course by an angle of drift.

6. CLIMB

1. Climb at nominal rating with C.A.S., given in Table 9. It is prohibited to decrease the climb speed below the given speed.

2. At T.O.W. 52,000, 48,000 kg, climb speed decreased by 5 km.p.h. as compared with climb speed at T.O.W. 36,000 kg.

3. Under adverse meteorological conditions it is prohibited to climb, if necessary, at take-off rating for a period of more than 15 minutes.

4. Table 9

Altitude metres	CAS, km.p.h.	Rate of climb, m.p.sec.	Time of climb, min.	Distance, km
TOW = 32,000 kg				
0	390	7	0	0
1,000	390	7	2	15
2,000	390	6.9	4	35
3,000	390	6.6	7	50
4,000	390	6.3	10	75
5,000	380	5.3	13	100
6,000	370	4.3	16	125
7,000	360	3.3	21	170
8,000	350	2.3	27	220
TOW = 28,000 kg				
0	390	7.5	0	0
1,000	390	7.5	2	15
2,000	390	7.5	4.5	30
3,000	390	7.3	7	50
4,000	390	6.8	9	70

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Altitude, metres	CAS, km.p.h	Rate of climb, m.p.sec.	Time of climb, min.	Distance, km	Fuel consumption, kg
TOW = 26,000 kg					
5,000	380	5.8	12	80	770
6,000	370	4.8	15	115	920
7,000	360	3.8	19	150	1,100
8,000	350	2.8	24	195	1,260
8,500	345	2.3	27	225	1,400

5. It is permitted to climb to altitude levels, depending on T.O.W., according to the table below:

At T.O.W., kg	27,000	up to 29,000	less than 48,000
Up to Altitude, m	8,000	9,000	10,000 (if necessary)

It is prohibited to decrease the climb speed below 325 km.p.h.

After climb to 4,000 m, the captain or the second pilot at the command of the captain puts on the oxygen mask and since then, during all en route flight till descent to 4,000 m, one of the pilots wears the mask.

7. HORIZONTAL FLIGHT

1. At a given flight altitude it is necessary to set engines at such a rating which provides the arrival of the aircraft in a point of destination on schedule. Choose the necessary rating in compliance with Table 40 but it should not be higher than 74 deg. on the fuel control lever position indicator.

In some special cases, engine rating of 74 deg on the fuel control lever position indicator is permissible, but it should not be assumed as initial in calculation of flight and its realization.

Under special flight conditions: while avoiding a storm-cloud area, or flying under icing conditions, or at high ambient air temperature, or in case of engine failure, it is permitted to run

Table 10															
Data for aircraft 1000															

1. All the data given for 4 altitudes are associated with standard ambient air temperature and normal engine regulation.
2. Indicated airspeed is not corrected for loading error.

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the engines continuously at nominal rating without time restrictions.

2. In order to achieve as soon as possible given cruising conditions, it is permitted to climb higher than the necessary altitude by 200-300 metres and then, while descending to the necessary altitude and after achieving the given speed, set the engines at cruising rating.

3. In the event, that the actual ground speed is less than the prescribed speed, set the engine levers at 74 deg. on the fuel control lever position indicator, recalculate time of arrival and inform the airport of destination about the aircraft being late.

4. For cruise performance data (from the regime of the smallest fuel consumption per km up to the regime of the highest speed), see Table 10 and Supplement 5.

5. Table 10 gives cruise speeds, fuel consumption per hour and engine ratings for four different groups of horizontal speed within the range of speeds from the lowest cruise speed up to the highest cruise speed:

1) Cruise at the lowest speed provides the highest endurance of flight and the min. fuel consumption per hour.

2) Cruise at the lowest fuel consumption per km. provides the longest range of flight at a given fuel weight. This technique is used for flights on schedule with favourable wind.

3) Cruise speeds at 0.85 of engine nominal rating (72 deg. on the fuel control lever position indicator). This cruise regime is used for flights on schedule in adverse wind and in still air. Time of operation of the engines at this rating is not limited.

4) Cruise speeds with engines running at nominal rating

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(84 ± 2 deg on the fuel control lever position indicator). This regime is permitted to use only under special flight conditions given in Table 10, and in test flights.

It is necessary to take into account (and write down with the Engine certificate) duration of engine running at ratings higher than 77 deg. on the fuel control lever position indicator. All the data in Table 10 correspond to flight conditions at standard ambient air temperature and normal engine regulation. In the event of deviation of temperature from standard, it is necessary for cruise regime 1,2 to keep C.A.S. given in Table 10 by resetting rating of the engines but the rating corresponding to 74 deg. on the fuel control lever position indicator should not be exceeded. For cruise regime 3,4 it is necessary to maintain engine rating given in Table 10 if the corresponding flight speed is within the range of 325-310 km/hr, CAS.

6. In level flight with engines set at 0.85 of nominal rating and less, at a standard ambient air temperature, the gas temperature downstream the turbine should not exceed 420°C . In the event of deviation of ambient air temperature from the standard temperature, the permissible gas temperature downstream the turbine will change by $\pm 1^\circ\text{C}$ per each $\pm 1^\circ\text{C}$ of deviation from the standard air temperature. Methods of determination of true ambient air temperature versus flight Mach Number are given on page...

If after the climb, the stable gas temperature in one of the engines exceeds 420°C , decrease the rating of this engine till the gas temperature is not higher than 420°C . If after a fall in power, the gas temperature does not decrease, stop the engine by feathering the propeller.

8. DESCENT

1. Before starting descent, the navigator must calculate time left before the beginning of descent in conformity with

instructions of the ground controller on altitude of approach to the airfield, and inform the captain of this time.

2. In conformity with the accepted schemes of approach, the following altitudes for an approach to the airfield (above the distant approach radio beacon) may be given: 3,900-4,200 m, 1,500 m and a "circle height over the airfield".

At an altitude of approach of 3,900-4,200 m the time for approach manoeuvres after passing the distant approach radio beacon, amounts to 12 min. If the aircraft passes the distant approach radio beacon at an altitude of 1,500 m, time for manoeuvres falls to 9 min. If the aircraft passes the distant approach radio beacon at a "circle height", the landing is made "straightly" without wasting time on manoeuvres.

3. Data of descent for all the three schemes of an approach to an airfield are given in Table 11. In compiling the table, the following allowances are made:

Descent speed, C.A.S., till altitude 4,000 m 450 km/hr

Descent speed, C.A.S., below 4,000 not more than 310 km/hr.

(engine levers are at 16 deg. on the fuel control lever indicator)

Rate of descent from altitude 3,000 to 4,000 m 3-6 m/sec.

Rate of descent from below 4,000 m up to 10 m/sec.

In descent, C.A.S. will increase, depending on the aircraft weight, fuel consumption and ambient air temperature. During descent it is necessary to keep C.A.S. not higher than 310 km/hr, or decreasing, if necessary, rate of descent.

It is prohibited to reduce in descent rating of the engines below 16° (on the fuel control lever position indicator).

If it is planned to descend at C.A.S. above or below 450 km/hr, the navigator must calculate the time of beginning

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of descent and inform the captain of this.

4. At an altitude of 400-600 m it is necessary to stop the operation of the cabin air conditioning system.

5. In descent, after reaching an altitude of 4,000 m, the pilot may put off his oxygen mask and separate its hose from the indicator.

**DESCENT DATA FOR THREE METHODS OF APPROACH
TO LAND**

Altitude to begin descent m	"Straight" landing			Approach from 3,500 m			Approach from 1,500 or 4,000 m		
	t min	L km	WT kg	t min	L km	WT kg	t min	L km	WT kg
10,000	26	262	825	32	237	1,015	30	197	920
9,000	23	225	740	29	200	930	27	160	865
8,000	20	190	650	26	165	840	24	125	775
7,000	17	157	560	23	132	750	21	92	695
6,000	14	126	465	20	101	655	18	61	590
5,000	11	95	370	17	70	560	15	30	495
4,000	8	80	270	14	50	460	12	0	395
3,000	6	60	200	12	30	390	-	-	-
2,000	4	40	130	10	10	320	-	-	-
1,500	3	30	95	9	0	285	-	-	-
1,000	2	15	60	-	-	-	-	-	-
0	0	0	0	-	-	-	-	-	-

Key to the table:

t..... flight time since the beginning of descent from a given altitude till touch-down, no wind.

L..... distance, flown by the aircraft since the beginning of descent till touch-down, no wind.

WT..... fuel weight, consumed in descent.

Descend from 1,500 or 4,000 m according to schemes of descent and approach, established by a given airfield.

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9. APPROACH, PRE-LANDING CALCULATION AND LANDING

1. After reaching the prescribed altitude of the rectangular pattern decrease the speed gradually down to 320 km/hr, then at an altitude of 400 m while crossing the distant approach radio beacon, extend the undercarriage.

2. Make the third turn at a speed of no more than 320 km/hr, extend the flaps by 15 deg.

3. After the fourth turn, extend the flaps by 30 deg or 40deg, depending on allowances made in the calculation, at a speed of no more than 300 km/hr. It is recommended to extend the flaps by 40 deg. after making the final calculation for landing.

4. Glide at a speed of 270-280 km/hr, depending on the landing weight of the aircraft. Apply bank by no more than 15 deg to make an accurate approach to the runway after passing the distant approach radio beacon.

In glide, bear in mind that in the speed range of 180-300 km/hr at various ambient air temperatures near the ground, in the vicinity of the airfield of destination, the propeller thrust needs more at the following engine control lever positions (on the fuel control lever position indicator):

Ambient air temperature °C	from 500 1-3	-6	-21	-31	-41	-51
	down to 435 1-5	-20	-30	-40	-50	-60
Engine control lever settings (on the fuel control lever position indicator) deg.	20 16	20	23	26	29	32

After the fourth turn, it is not recommended to set the engine control levers below the above mentioned positions (settings) till the beginning of flare-out because it results in

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objectionable negative thrusts.

While landing the IL-18 (especially, at small all-up weights) on airfields with

- a) runways of limited length - less than 2,000 m;
- b) restricted airways to approach an airfield;
- c) ambient air temperature on ground level within $0^{\circ}+30^{\circ}\text{C}$,

if permitted - at the captain's own discretion - put the control levers of two inner engines on the stop "Ground-Idling" ("Zero on the fuel control lever position indicator) to brake the aircraft in air while flaring-out at a height of 1 m. In case of appearance of the tendency to drop the aircraft nose, counteract it by pulling smoothly the control column backwards to land with the nose wheel lifted by 10-25 cm.

- WARNING:**
1. On approaching to land it is prohibited to move the engine control levers from "Flight-Idling" ($16\pm 1^{\circ}$ on the F.C.L.P.I.) till reaching the height of no more than 1 meter above the runway.
 2. Illumination of the Warning Light located in the feathering button KPB-37 while flying with the control lever at 16° on the F.C.L.P.I. and at ambient air temperature below -40°C , is not a command to feather the propeller if there is no other indications of engine failure.

3. Pass the near approach radio beacon at the altitude prescribed for this particular airfield at a speed of 240-250 km/hr, which should be maintained till the beginning of flaring-out (8-10 metres above the runway).

4. Landing must be performed with the nose landing gear slightly raised (the distance between the lower point of the wheel and the runway must be 10-25 cm).

5. Landing speed must be 180-200 km/hr depending on the aircraft weight.

6. After touch down set the engines at "Ground Idling" and remove the propeller stop.

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WARNING: It is prohibited to remove the propeller stops at a speed more than 180 km/hr.

9. Wheel brakes are recommended to be used during second half of the landing run at the speed not exceeding 150 km/hr and without abrupt braking when enough of the runway length is ahead.

10. During landing with on the nose gear steering at a speed not higher than 130-140 km/hr.

11. When safety speed for taxiing is achieved flaps must be retracted and after leaving the runway outboard engines must be switched off and taxiing must be performed with inboard engines operating (when the runway is concrete). When taxiing is performed over unpaved strips outboard engines must not be switched off. Secure the guard of the landing gear up knob with a stud during taxiing.

12. Switch off the bariscope recorder V K2-75.

13. Reduce pressure in the cabin by smooth opening of the window pane in the cockpit during taxiing.

10. LANDING OF THE AIRCRAFT WITH WEIGHT EXCEEDING NORMAL LANDING WEIGHT

1. In some special cases the aircraft is allowed to land with weight exceeding the normal landing weight and sometimes equal to the take-off weight, but the aircraft must touch down smoothly and the captain must pay maximum attention to landing (after landing thorough examination of the landing gear and their attachment must be performed).

2. Glide during approach with weight exceeding normal landing weight must be performed with the speed of 280-290 km/hr.

3. The operating regime of the engines must not be below 14-15 by the fuel pressure gauge position indicator.

4. Before touchdown the speed is reduced to 290 km/hr.

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and the aircraft is led to the ground smoothly at slightly increased speed with a view of touching down the runway at a speed of 210-220 km/hr.

11. LANDING IN SIDE WIND

1. During landing approach in side wind drift must be offset by the corresponding angle. Before touch down move the rudder pedal in the direction of drift and turn the aircraft to correct position along the runway axis.

2. Touch down speed must be by 10 km/hr higher than in landing under normal conditions.

3. After touch down the nose wheel must be smoothly lowered down and, if necessary, apply brakes of the main undercarriage wheels, opposite to drift.

4. If necessary nose wheel steering is allowed during the whole landing run.

5. Permissible speed of side wind (at 90° to the runway) must not exceed 15 m/sec.

12. TAKING OF A MISSED APPROACH ACTION.

Taking of a missed approach action with all engines operating and the undercarriage and flaps in landing position is possible from any height before flare out.

While taking a missed approach action the captain must do the following.

1. Maintain the speed and give the flight engineer the command to set the engines to the take-off regime and retract the undercarriage

2. After clearing obstacles of not less than 50 m retract the flaps at the speed not higher than 300 km/hr.

3. Gradually increase the speed with a view to achieving 300-320 km/hr at the height of 100 m. Balance the aircraft with the trim tabs.

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4. At the height of 100 m set the engine at nominal rating.

13. TAXYING TO THE PARKING PLACE AND STOPPING OF THE ENGINES

1. Before taxiing to the parking place get sure of the normal operation of the brakes and that the pressure of the hydraulic accumulator is in the order of 225-140 kg/cm².

2. If taxiing to the parking place is difficult, stop the aircraft about 50 m from the parking place and cut the engines out. Then the aircraft is towed to the parking place by the truck.

3. During taxiing the second pilot must watch the obstacles and report about them to the captain.

4. After taxiing to the parking place and cutting off the engines it is necessary:

- to apply the parking brake
- lock the aircraft control
- cut out energy supply to services which are not used.

After landing and cutting out outboard engines the operating engines (2nd and 3rd) are to be cut out in the following order:

- a) stop the 3rd engine
- b) switch off the generators of the 2nd engine for 3-4 sec. and see that there is voltage (on distributive busbars from the batteries), that warning lights are lit, that the voltmeter of the distribution system shows voltage and so on.

c) connect the generators of the 2nd engine to the aircraft system and stop the engine according to the Instruction.

d) if after disconnecting the generators there is no voltage in the aircraft system it is necessary to connect the generators again to the aircraft system and see that the voltage of the aircraft system is 27-28.5 v, after that stop the engines and close the fuel shut off valve.

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- after stopping the engines switch off all electrical systems except lighting.

14. NIGHT FLIGHTS

1. Taxiing must be performed with the landing lights and navigation lights switched on. The landing lamps must be lit for no more than 5 minutes.

If prolonged lighting is necessary switch the clearance wing lights and fuselage lamps in turn.

2. Take-off is performed in the same way as during day time but, as a rule, the landing lamps must be switched on. At the height of 90-100 metres the landing lamps must be switched off and retracted.

3. Flight along 'rectangular pattern' must be performed along the same route, with the same speed and on the same altitude as during day time. Bank during turns must be 15-20°.

4. Landing approach must be performed in the same way as during day time. The landing lamps must be extended after the 1st turn and switched on at the straight line at the height of 90-100 metres.

5. Landing must be performed in the same way as during day time.

6. During night flights it is recommended for the captain to use oxygen for 5-10 minutes before take-off for recreation.

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CHAPTER IV

FLIGHTS UNDER ADVERSE METEOROLOGICAL CONDITIONS

PILOTING THROUGH AREAS OF ATMOSPHERIC TURBULENCE

1. SPECIFIC FEATURES OF THE ATMOSPHERE AT HIGH ALTITUDES

1. Most often severe turbulence, the phase of rough air flight, develops under the following meteorological conditions:

a) in the zones of jet streams of great vertical wind shear and great horizontal wind velocity variations, especially in the regions where vertical wind shear exceeds 3 m/sec per 100 m and horizontal wind velocity changes exceed 6 m/sec per 100 km. Such conditions are generated in the cold area of the jet stream below its axis. When convection develops in the troposphere in warm seasons intense rough air may occur even under conditions of small vertical wind shear and small horizontal wind velocity variations;

b) in the layers 1-1.5 km thick under those areas of the tropopause where the slope of the latter exceeds 1:300, that is the tropopause height changes by 1 km per 300 km of horizontal extent. Such steep slope is most probable over pronounced cold fronts with a strong temperature gradient. Frequently turbulence develops in case of increase of temperature with variation in height (inversion) and rather seldom it occurs in case of slow decrease of temperature with height (isotherm) over the tropopause;

c) in the zones of fronts, and especially in the areas of pronounced cold fronts of intense cloud formations;

d) in cumulus congestus and cumulo-nimbus clouds and near their edges, especially during storm activity;

e) in alto-cumulus castellatus clouds which signify sharp development of convection and potential thunderstorm;

f) in alto-cumulus lenticular clouds. These clouds are characterized by strong vertical updrafts over mountain routes. The main cause of their generation are the air waves moving from the lee side of the ridges;

g) in the clouds of the upper and middle layers associated

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with the jet streams.

2. Severe turbulence may be expected when some of the conditions mentioned in paragraph 1 occur in combination. For example, it may develop in case of a great slope of the tropopause and severe clouds below it or while flying through the cold base of the jet stream in the zone of cold front activity.

3. The main factors which should be estimated for locating areas of probable severe turbulence are: the slope of the tropopause, the character of clouds, occurrence of jet streams and the position and altitude of the layer with the wind speed maximum.

2. FLIGHT PREPARATION, CLIMB AND ENTRANCE INTO THE CRUISING LEVEL.

1. During flight preparation it is necessary to make thorough analysis of meteorological conditions of each part of the route. In case some zones of the route are threatened by adverse weather conditions, that is, where strong disturbances of the atmosphere may occur (such as frontal thunderstorms, hearths of upper air cyclones), the captain shall flight plan temporary route alterations to avoid them by: decreasing flight altitude or by small deviation from the heading and coordinate it with the corresponding air traffic control stations. The necessary increase of fuel must be envisaged without exceeding maximum permissible take-off weight (fuel reserve must be untouched). Side deviation of the aircraft is limited by the action radius of navigation and communication equipment.

2. During flight planning the route and regimes of climb and descent must be defined depending on location of zones of potential turbulence and jet streams.

The route must be laid through the warm (anticyclonic) side of the jet stream where the development of turbulence is least

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possible.

In case the opposite (head) jet stream it is also recommended to lay the route through the anticyclonic side of the jet stream where the headwind is of lesser speed.

Besides while choosing the route it is to be remembered that in the high cold regions of low-pressure (the area of the lower tropopause) turbulence develops more often than in the high warm anticyclons (the area of the higher tropopause).

Yet when convection and cumulo nimbus clouds develop intense rough air is found also in the western and northern parts of warm anticyclons (under the area of the higher tropopause). In case the tropopause is below the permissible flight altitude, crossing level must be chosen over the tropopause. The latter must be crossed at the zone of slightest sloping.

If the tropopause is over the permissible flight altitude, cruising level is recommended to be chosen in the region of not less than 2 km below the altitude of maximum wind velocity. The zone for initiating descent is to be chosen with a view to avoid crossing a pronounced cold front of cumulo nimbus clouds with intervals between them of not less than 50 km during descent.

3. No later than 30 minutes before take-off the captain must be thoroughly consulted on synoptics at the Central Aeronautical Meteorological station and study synoptic situation from the upper-air maps of baric topography and terrestrial weather maps, atmospheric vertical cross section and actual weather data received from other flying aircraft.

Special attention must be paid to the location of hearths of storms, cumulus congestus clouds and their upper edge, source regions of rough air, to speed and direction of wind and to temperature, taking into account information of meteorological reconnaissance flights and data measured onboard the aircraft.

the same time attention must be paid to the location of the tropopause layer and the special position of the front.

It is not recommended to cross the tropopause in the zone of the slope of the order of 1:100-1:300, as in such a case the aircraft may be thrown up.

Remember that intensity of thunderstorm and vertical development of cumulo nimbus clouds increases towards the center of an upper air cyclone and, on the contrary, it lessens towards increased atmospheric pressure.

4. Due to the limited extent of zones of weather conditions contributing to generation of rough air, dangerous for the aircraft, flight must be cancelled or stopped only in those cases when it is practically impossible to fly. Such a situation may be met, for example, in case of an intense front between the airports of departure and destination. In this case, this is a cold front of cumulo nimbus clouds (width of the front more than 500 km), with closely positioned bands of clouds along it and with the upper edge of the front at the altitude of 10-12 km.

Night flights are allowed only after thorough analysis of weather conditions showing that generation of rough air en route is excluded.

5. During flight, time the crew must observe the corrections, to the information on meteorological conditions by questioning Central air traffic control stations or by observation on route, in full or by observation of clouds.

Central air traffic control stations must report to the crew about all changes in meteorological conditions: maximum wind speeds, changes of front position, change of the height of the tropopause, and must report about weather in the intermediate zones.

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request from the aircraft and also after receiving new information and forecasts from prognosticators.

WARNING: Crews are obliged to report to Central air traffic control stations and Air Traffic Control stations, as well as to the aircrafts flying in opposite direction information about speed and direction of wind, outside air temperature, character of clouds and their upper edge and the intensity of rough air. At the same time they must report the region, altitude and time of the observed phenomena.

6. The crew of the aircraft must systematically make calculations of speed and direction of wind, follow the changes of ambient air temperature, watch orientation of cloud systems and forms of clouds above and below the ^{level} cruising V. Information received by radio, and the results of observations make it possible to define more exactly the aircraft's position relative to atmospheric fronts, jet streams and the tropopause.

7. In more exact defining the aircraft's position relative to the jet stream and the tropopause the following must be taken into account:

The presence of the jet stream is determined by any of the four types of clouds:

1. cirrus "bundle" like clouds having the form of swiftly moving long ridges
2. cirrus-stratus "carpet type" clouds with wavy ridges which constantly change their form and turn into cirrus bundle type clouds
3. altocumulus lenticulars of considerable extent in the stream's direction and often of the multistrata type
4. altocumulus fleecy clouds with the wave direction perpendicular to the jet stream.

Cloud formations of the jet stream usually extend along the stream and are present in its warm (anticyclonic) side, that is to the right of the stream's direction. As a rule cloud formations are located several hundred metres below the maximum wind velocity

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layer (the jet axis) Maximum wind speed takes place over the left boundary of the cloud formation.

Heavy rough air occurs in the clouds with uneven boundaries of cloud layers quickly changing their structure. Under these conditions contrails of the aircraft swiftly deform and dissipate.

Entrance into the jet stream is accompanied by the increase of wind speed. The greater is the angle at which the jet stream is crossed the more prominent is the increase of the wind speed.

It should be borne in mind that during flights along the jet stream temperature and wind speed change but little. When the aircraft crosses the jet stream sharp changes of temperature, wind speed and drift angles of the aircraft take place. During transition from the central part of the stream into the cold one the wind weakens quickly and there is sharp decrease of temperature. During transition from the centre into ^{the} warm side slow wind weakening occurs, while temperature gradually rises.

The accomplishment of the tropopause crossing during climb is signified by the decrease of lapse of temperature or by constant temperature.

8. It is necessary to remember that turbulence, most dangerous for the aircraft, is present in the developing cumulus congestus clouds, the top of which reaches 7000 metres and especially in the hearths of storm activity. In these cumulus congestus clouds the center of the strongest rough air is at the height of 6-7 thousand metres and it is being generated at the moment the cloud top begins to ice. Indicated speed of the vertical gusts in it is as high as 6-8 m/sec. Vertical ascending currents are prevailing in such clouds.

While crossing zones of severe turbulence in the forming cumulus congestus cloud the aircraft is thrown up by vertical gusts and is moved up further by the ascending current. As such,

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Beyond is of small extent the aircraft usually passes the turbulent area in 5-10 seconds.

Echoes from such a cloud appear on the radar's scope only within 5-8 km distance between the aircraft and the cloud, that is why it is possible to go around it only in case of visibility. The top of such a cloud is dome shaped with ^{several} ~~surrounding~~ small "brooms".

Zones of dangerous turbulence which occur in cumulo nimbus clouds in the stage of their maximum development and division are characterized by vertical gusts of 10 m/sec and are clearly seen on the radar's scope within the range of 40-200 km (the range depends on the intensity of storm clouds).

Turbulence beyond the boundary of storm hearth is not dangerous for ^{the} aircraft. At a distance of 8-10 km beyond the boundary ~~the~~ storm hearth (which is shown on the radar's scope) field tension of static electricity is more than 300 v/cm. Due to such tension the aircraft flying through clouds or precipitation, and especially while passing between hearths of storms, may be struck by lightning.

Vertical ascending currents are found over cumulus congestus and cumulo nimbus clouds during their development.

In cumulo nimbus clouds even at high altitudes the aircraft may penetrate the zones of over-cooled fluid precipitation and may be subjected to heavy icing.

3. PILOTING THROUGH ZONES OF ROUGH AIR AND STORM ACTIVITY

For ensuring safety of flights under conditions of rough and storm activity the captain should be guided by the following rules:

1. Entrance into cumulus congestus and storm cloud formations is strictly forbidden.

To prevent the possibility of losing control in case of sudden gusts the crew must be in fastened safety belts during

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the whole flight.

2. In case the aircraft penetrates the rough air area or zone of storm cloud formations the calibrated air speed of the aircraft must be in the order of 400-420 km/hr.

3. Climb is not recommended in the area of rough air (especially at the altitude of 8000 or more metres).

In case of necessity climb for ensuring flight over clouds must be performed before entry into the zone of rough air.

Calibrated speed during climb must ^{not} be less than 380 km/hr.

The power of engines is allowed to be increased to the take-off rating (no more than 15 minutes) to maintain the above mentioned speed.

When the aircraft penetrates the zone of rough air, ^{the} course or altitude of flight must be changed. In accordance with Central air traffic control station.

4. Traverse of areas of storm activity during flight over cloud formation is forbidden with exception of cases when the upper edge of the clouds lies not less than 500 meters below the lower flight altitude limit for the aircraft of given weight.

5. The aircraft must fly at an altitude of not less than 500 metres above the upper edge of the clouds. The flight altitude must not exceed the maximum permissible altitude.

6. When the radar fails traverse of the storm front over clouds is allowed only in daytime with visual aids.

When frontal clouds with several hearths of storm are met during flight the aircraft is allowed to cross them only visually and in the region where the storm hearths spacing is of not less than 20 km (which is seen on the radar scope).

In all other cases areas of storm activity must be passed around after detecting them on the radar. While passing around the distance between the storm hearths shown on the radar's scope must be not less than 10 km.

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During visual flight when tops of cumulo nimbus clouds are met on the flight altitude it is necessary to pass around them at a distance of not less than 5 km from the boundary of the clouds.

5. During flights near the zones of the storm activity the radar "Emblem" is to be switched to the regime "collimation" and spacing between the hearths of storm are to be increased.

In case of the frontal storm the altitude of the upper edge of the storm is to be located by raising the antennae.

6. When it is not possible to pass around zones of storm activity at some distance by above mentioned methods it is necessary to return to the airport of departure or the nearest intermediate airport.

The change of the course must be performed smoothly in ^{the} zone of the slightest rough air. Bank angle must not exceed 15°. During turns the crew must follow speed indication ~~on speed must~~ not fall below 400 km/hr.

7. Turns with climb are not recommended. Sharp movements of the control surfaces, and especially the elevator, are not allowed.

8. In all cases when the aircraft penetrates the zone of rough air it is not recommended to maintain strictly the initial altitude and speed. Piloting must be performed with the control column gripped with some force. Piloting of the aircraft must be performed according to the average indication of the artificial horizon without sharp roll, pitching up and abrupt movement of the aileron ^{hand} wheel.

9. When the aircraft is unexpectedly thrown up and the flight altitude increases due to the strong ascending current, flight speed must not be allowed to fall and the power of the engines must not be decreased.

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In case of considerable increase of flight altitude, accompanied by transition to dive, caused by the ascending current of considerable extent, the aircraft must be maintained in the initial regime, must not be prevented from climbing and must not be transferred into steeper dive.

In these conditions it is necessary to follow attentively indications of the Mach Number indicator and speed indicator and not to allow the rise of M and speed above 0.85 and above 915 km/hr respectively.

During intensive descent of the aircraft caused by a descending strong current the flight must be maintained in the initial regime; the aircraft must not be prevented from lowering by transition to pitching up and it is necessary to watch the indication of speed and not to admit considerable deviation from the speed of the initial regime.

10. In case of involuntary entering high angles of attack slight vibration of the aircraft starts and the control surfaces begin to shake with further intensification of shaking. In the time of shaking control surfaces are effective enough. When shaking starts it is necessary to increase the speed of flight immediately and if shaking starts during turn it is necessary to go out of turn with increased speed.

If the aircraft downs its nose after entering high angles of attack it is necessary to retain the aircraft from the tendency to roll while the speed increases and gradually transfer the aircraft to horizontal flight.

11. If the artificial horizon AF6-2 fails (in case of its toppling) use the indication of the artificial horizon AFH-1c but remember that the latter has inverse indication.

12. If during flight through clouds the aircraft must

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traverse the zone of storm activity (which may happen during descent) it is necessary:

- to locate the hearths of storm on the radar scope by periodically switching the radar into the regime "collision" (when the radar works in the regime "scanning" the hearths of storm differ from the terrain features by the shade on the hearth's boundary and, if the antennae is turned, they change but little); besides at a distance of 50-100 km from the heart of thunder storm interference to radio takes place;

- to choose the area for passing through the zone of storm activity at a distance of not less than 100 km from the hearts of storm. Traverse of the area between the hearths of storm is allowed when the distance between them is equal to or exceeds 50km;

- when the aircraft approaches to the boundary of the storm hearth by 25-30 km it is necessary to switch off the communication station and to minimise the risk for the crew to be struck by lightning. It should be borne in mind that when the aircraft approaches to the hearths of storm it may penetrate the zone of intensive precipitation which gives flares on the radar scope and make location of the storm hearths difficult.

13. In all cases when the aircraft penetrates the zone of rough air it is necessary:

- to switch off the autopilot if it is switched on;
- to become sure that heating system of the receiver is switched on;
- to ask passengers to fasten safety belts.

14. Entrance into clouds, as a rule, must be performed at the established regime as penetration of clouds at the unsteady regime with bank is dangerous due to the fact that during restoration of horizontal flight under rough air conditions it is easy to make

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errors in piloting the aircraft.

15. The captain must not leave his place during approach to the probable zone of storm activity or severe turbulence.

DESCENT, PASSING THROUGH CLOUDS AND LANDING APPROACH UNDER ADVERSE METEOROLOGICAL CONDITIONS

1. DESCENT FROM THE CRUISING LEVEL, PASSING THROUGH CLOUDS AND LANDING APPROACH USING INSTRUMENT LANDING SYSTEMS OM-40 AND OM-50 (KCH)

Basic manoeuvres of descending, passing through clouds and landing approach are the following:

- carrying out of "great rectangular pattern"
- carrying out of "small rectangular pattern"
- landing "from the straight line"
- carrying out of the manoeuvre when the course of the aircraft is opposite to the landing course;
- carrying out of the manoeuvre when the course of the aircraft is normal to the landing course.

Description and methods of carrying out the above mentioned manoeuvres are given in special albums.

In each airport special schemes of manoeuvres of the aircraft during descent, passing through clouds and landing approach depending on local conditions are worked out on the basis of above mentioned typical schemes of manoeuvres (landing from the straight line included).

During manoeuvres of descent, passing through clouds and landing approach under adverse meteorological conditions the crew makes use of special equipment onboard the aircraft in coordination with ground equipment.

- a) the radar on-board the aircraft, designed for detection of hearths of storm and rain in clouds, air craft in collision course, ground obstacles and for determination of wind vector and terrain

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scanning;

b) two sets of radiocompasses used for aircraft navigation by Ground Radio Stations (GRS) for determination of the aircraft position by taking the bearings of ground radio Stations and for carrying out the approach, instrument landing by the system OCH-48.

c) instrument landing system indicators ILS-48 used for landing approach by localiser and glide path beams of the instrument landing system ILS-50 and in case of a complete complement, by standard ILS systems

d) command VHF receiving-transmitting set used for landing approach by ground radar means;

e) course system for precise maintenance of true, magnetic and orthodromic course;

f) several sets of operating and standby artificial horizons ensuring piloting of the aircraft in accordance with assigned parameters of pitch and bank when ground and natural horizons are not seen;

g) barometric altimeters showing relative altitude of the aircraft over the airport of standard pressure and a radioaltimeter indicating true height over the terrain;

h) integrated indicators of calibrated and true airspeed, a variometer indicating vertical speed of descent and climb.

The above mentioned equipment used as a complex and due to duplication ensures complete safety of flight and landing of the aircraft under adverse meteorological conditions during day and night and in cases when some of the instruments fail.

The captain and the navigator must check the instruments for condition before each flight.

Check of the ICH-48 is performed with localiser and glide

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path beacons operating when the aircraft is positioned for take-off exactly along the axis of the runway. In this case the course pointer must be in vertical position in the centre of the scale while the pointer of the glide-path must be in the upper position.

Windows showing satisfactory operation of the localizer and glide path beacons must be covered ^{with} black flags. Check and regulation of the electric zero of the course pointer of the **NCN-48** system ^{are} performed by pressing and turning the handle "Balance - Zero control" at the control panel.

2. DESCENT, PASSING THROUGH CLOUDS AND LANDING APPROACH ALONG "GREAT RECTANGULAR PATTERN"¹⁾

The initial point for planning landing approach pattern is the distant approach beacon to which the aircraft is guided from the approach airways at the altitude determined by the instructions for flights over the aerodromes.

The altitude for entering the zone of the distant radio beacon may be the following: in case of the manoeuvre along "the great rectangular pattern" 3900-7000 metres, and in case of flight along "the small rectangular pattern" 1500 m and less.

Before initiating descent the compass system KC-6 must be switched over to the regime of the gyrocompass **GNK** preliminary matching the heading.

Lowering down of the aircraft from the ^{cruising} level to an altitude of 3000-4000 m at which the aircraft approaches the distant approach radio beacon is performed by the captain in accordance with the air traffic controller command. Rate of this descent is 5 m/sec and calibrated speed is in the order of 430-510 km/hr. At the height of passing over the distant radio beacon calibrated speed must be decreased to 400-420 km/hr.

1) All flight altitudes and ^{vertical} rates of descent are given for the standard scheme

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While flying over the distant radio beacon, set the control levers of all four engines in position at $16^{\circ} \pm 1^{\circ}$ on the fuel control lever position indicator irrespective of ambient air temperature and initiate descent with vertical calibrated speed of 10 m/sec.

During descent calibrated speed increases depending on weight regulation of fuel consumption and ambient air temperature.

While descending it is necessary to watch the air speed indicator. It must not exceed 510 km/hr and if it is necessary the rate of descent must be decreased.

Descent to the height of 2800 m must be performed in 1.5-2 minutes. At this height turn for 180° with bank of $15-20^{\circ}$ is initiated. During lowering down calibrated speed of descent must not exceed 510 km/hr.

Turning manoeuvres must be accomplished at the height of 1200 metres.

After this turn flight goes on with further lowering down to the height of 600-400 m with the course opposite the landing course and with the same parameters of speed, then descent is stopped and level flight goes on with further reduction of calibrated speed to 350 km/hr.

When the distant approach beacon is seen on the perpendicular to the flight path the landing gear is extended.

In 60 seconds after traversing the distant radio beacon (when the latter was seen on the perpendicular to the flight path) turn with bank of 15° is carried out at a relative bearing of 245° (or 120° when the turn is to the right) and at CAS 350-320 km/hr. (It is the third turn of the standard rectangular pattern).

After the turn the aircraft maintains level flight and when

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the speed is 320 km/hr flaps are extended by 15° .

Flight with this course continues until the aircraft goes out to the relative bearing of 290° (or 70° , when the turn is to the right). Then the 4-th turn with bank of 15° is performed with CAS 320-300 km/hr and the aircraft goes out onto the landing line.

Entrance onto the landing line may be accomplished with the course system (preliminarily corrected and working in the regime of the gyrocompass ΓK together with the radio compass APK-5), with the localizer of the instrument landing system CП-50 , with PCП , with the VHF automatic direction finder and other means. Going out from the 4-th turn may be at the height of 600-400 or 300 m depending on terrain features.

While flying along the straight line after the 4-th turn flaps must be extended from 15° to 30° and the calibrated speed must be reduced to 280-270 km/hr.

Further on the aircraft flies along the landing line with correction of errors in the landing course, made during the 4-th turn, and selection for offset to overcome drift angle (in side wind).

In the course zone the drift of the aircraft is overcome by offset (of the course system working in the regime of the gyrocompass ΓK) to the landing course by the value of drift angle $\Delta\alpha$ by further selection of the course. The course pointer of the instrument landing system PCП-48 is held in the centre of the black circle and then the aircraft follows along the axis of the course zone.

In case of radio equipment with ~~and~~ ^{and} ~~regulation~~ ^{regulation} it is not necessary to try to go into the landing line immediately after entrance into the course ^{zone} in other words it is not necessary to

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hold the course pointer of the ILS-48 system within the black circle. Before passing over the near approach radio beacon the course pointer may be in any part of the instrument scale of the ILS-48, but when the aircraft is over the near approach radio beacon, the pointer must not go beyond the first dot. The main task of the crew is to select such a course at which the pointer will slow down its motion and will stop when it comes to the black circle on the scale. This is the landing course which must be maintained while passing over the nearest approach beacon or the middle marker of the ILS system.

Corrections of direction errors are made with the help of radiocompass ARK in the following order:

a) if after going out from the 4th turn the pointer of the radiocompass APK shows radio station relative bearing 0 but the course of the aircraft exceeds the landing course, it is necessary, in accordance with IIRK, to turn the aircraft further to the right for the value of the error, and when the radio station relative bearing approaches 360° without doubling the error it is necessary to direct the aircraft to the distant approach radio beacon again by the radio compass.

b) if after going out from the 4th turn the pointer of the radiocompass APK shows the radio station relative bearing 0 and the course of the aircraft is less than the landing course, it is necessary, in accordance with IIRK, to turn the aircraft further to the left for the value of the error and direct the aircraft to the distant approach radio beacon again by the radiocompass.

The aircraft intercepts the glide path at the height of 400 m at a distance of 8-9 km from the touch down.

During approach to the glide path zone the pointer of the

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glide path indicator of the ICH-48 system will start moving away from the end of the scale. When the pointer comes to the white circle, the aircraft is smoothly transferred to descent with speed of 3-4 m/sec (with the pitch angle of -5° on the artificial horizon AIB-3).

Piloting through the glide path zone is performed by maintaining the glide path indicator pointer in the centre of the black circle or at its upper edge when the aircraft goes along the lower border of the glide path.

If the aircraft goes properly in the glide path and in proper direction it must pass over the distant approach radio beacon with rate of descent of 3-4 m/sec at a height of 200-220 m.

If the aircraft lost height to 200-220 m before passing the distant approach radio beacon, it is necessary to stop descending and follow to the distant approach radio beacon at the height of 200 m with calibrated speed of 270 km/hr, then to transfer the aircraft to descent with rate of 3-4 m/sec and watch the height at which the aircraft will pass over the near approach radio beacon.

(in conditions of clouds at the height of 100-150 meters after passing over the distant approach radio beacon and
when the crew visually observes the landing runway with take-off equipment, the captain makes landing calculations, fully extends flaps and reduces calibrated speed to 250-240 km/hr with corresponding rate of descent of 3-4 m/sec.

The aircraft must pass over the near approach radio beacon at the height, prescribed for the given airport. Calibrated speed of 250-240 km/hr must be maintained till the height where flaring out is initiated.

After flaring out calibrated speed at the moment of touch

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down must correspond to the landing speed (180-200 km/hr).

3. APPROACH TO THE COURSE AND GLIDE PATH ZONE FROM GREAT DISTANCES AND LANDING FROM THE STRAIGHT LINE.

Landing from the straight line is carried out in good visibility, small traffic in the zone of the airport when the aircraft approaches the near approach radio beacon with course equal to or differing from the landing course by no more than $\pm 30^\circ$.

In the zone of the air traffic control (ATC), at a distance of 75-85 km from the airport, the captain, in conformity with the controller's instructions, initiates descent from the height of 4000 m with CAS 450-510 km/hr and rate of descent of 8-10 m/sec, bearing in mind to approach the airport at a place of 12-15 km from the airport and at the height of 400 m with the course corresponding to the landing course. At some distance the aircraft will enter the zone of the localizer and the window on the dial of the HCH-48 will be covered with a black flag and the course pointer will move away from the edge of the scale.

In the zone of the localizer it is necessary to check the setting of the course pointer on the electric zero by pressing the button "Balance - Zero Control". If the course pointer does not show "Q", it is necessary to put it in zero position and then direct the aircraft ^{to} the landing ^{also} course, using ^{two} indications of two radio compasses, tuned to the distant approach radio beacon and to the near approach radio beacon. At 12-15 km from the aerodrome when the aircraft is at the height of 400 m it is necessary to reduce calibrated speed to 350 km/hr, extend the landing gear, then to reduce calibrated speed to 320-280 km/hr and extend the flaps by 15° . At the height of 400 m and at a distance of some 6-7 km from the runway the aircraft will enter the glide path of the (KCH). Further on the landing will continue in the same way as after the 4th turn in case of "great rectangular pattern".

CHAPTER 5
SPECIFIC FLIGHT CONDITIONS

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An engine or propeller governor failure in a turboprop airliner may give rise to a high propeller drag (negative thrust).

To prevent danger from negative thrust the flight crew must keep close observation on the operation of the engines and in the event of an engine failure, feather immediately the propeller of the failed engine.

Special attention should be given to the engines while flying in rough air and approaching to land.

The flight engineer is obliged to be at his station, keep close observation on the engine group instruments and inform the Captain immediately about failure. At the command of the Captain, the flight engineer must feather the failed engine.

In case the flight engineer is compelled to leave his station whilst the aircraft is flying en route, one of the pilots must take upon himself observation on the engine instruments.

WARNING: It is prohibited to remove the propeller steps in flight (from take-off till touch-down).

Pilots for the IL-18 airliners must be trained to pilot the aircraft with engines inoperative.

1. MAIN INDICATIONS OF ENGINE FAILURE IN FLIGHT.

To determine which engine fails, it is necessary to look for the following indications:

- a) Pressure fall in the torque meter of a failed engine;
- b) fuel pressure fall at the steady position of the engine control lever - indicates an engine failure;

fuel pressure fluctuations at the steady position of the control lever indicate a propeller governor failure;

- c) rise or fall in engine r.p.m. outside the permissible limits, or fluctuation of r.p.m.;
- d) rise or fall in gas temperature;
- e) oil pressure fall below the normal limits;
- f) illumination of the warning light located in the feathering

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button KOL-37, illumination of the lamp warning about propeller in the pitch controller line or in the fine-pitch line; or simultaneous illumination of both warning lights.

The pilot will know about an engine failure from the tendency of the aircraft to turn and bank to the side of a failed engine, followed by braking in the direction of flight.

WARNING: In all cases of engine failure or malfunction, the flight crew must feather the propeller of the failed engine, and close the stopcock and engine fuel shutoff cock. Use the emergency system to ensure that the engine is feathered and stopped. For the purpose, pull the emergency feathering lever and leave it in this position till the end of flight.

2. TAKE-OFF WITH ENGINE FAILURE.

1. The IL-18 take-off critical speed is 170-180 km.p.h., CAS. In the event of an engine failure at a speed below the critical speed, the captain must stop take-off. If an engine fails at a speed of 170-180 km.p.h. or higher, the Captain may continue or stop take-off.

2. If the captain makes a decision to stop the take-off, apply all means of braking to decrease the speed in the following consequence:

- move the engine control levers to "Ground-Idling";
- put the intermediate propeller stop switches of two symmetrical engines operating to "stop removed". Then, during the following braking, remove the stop of the third operating engine and, if necessary, switch on the steering of the nose wheel and apply the wheel brakes. If the runway is of an adequate length, do not brake intensively at a speed of more than 170 km.p.h. It is possible for the IL-18 with wheels KT-81/3 to apply brakes and remove propeller stops simultaneously. Table. below gives the actual data of IL-18 interrupted takes-off.

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Table.....

T.O.W. kg	Meteorological data			CAS km.p.h.		"accelera- to-stop" distance, metres	N o t e
	Atm. pressure mm of mercury	Tempe- rature °C	Wind velo- city mps	engine failu- re	braking		
60,300	727.0	+23	1.0	200	170	2,800	wheels ST-31/3M
61,000	716.0	+34	3.0	210	218	2,170	wheels ST-31/3
58,500	715.0	+29	2.0	185	195	1,630	---

- N O T E: 1. Engine failure in run was simulated by stopping (feathering) engine No 4.
2. Two seconds later, two inboard engines were set at "Ground-Idling" and the propeller stops removed.

Aircraft speed increases slightly for the first 4-5 seconds after the engine stoppage.

3. If the Captain makes a decision to continue the take-off with three engines operating, the crew must proceed as follows:

a) The Captain removes the tendency of the aircraft to turn by applying the rudder and ailerons. The rudder should be applied energetically, especially at low speeds. During run, the ailerons should be extended to half their travel. Bear in mind that total loads with an outer engine inoperative may amount to 70-80 kg and aileron control wheel load to 25-30 kg. In aircraft equipped with aileron control system of a developed type, aileron control wheel load is 15-20 kg.

b) The flight engineer keeps close observation on the engine group instruments. If autofeathering does not work, the engineer immediately feathers the failed engine by pushing the feathering button and uses the emergency feathering system to ensure that the propeller is feathered. For this purpose he pulls the emergency feathering control stick as far as it goes, applying a force of about 50 kg, and leaves it in the extended position till the end

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of flight. Then he closes the engine stop-cock and fuel shutoff valve.

o) If deflection of the rudder removes the tendency to turn only partially, apply slightly and for a short period - the bogie brakes on the side of the operating engines.

d) Unstick at a speed of 240-245 km.p.h. (if runway length permits).

e) After engine failure, make the aircraft to bank in due time by 3-deg. to the side of the operating engines.

WARNING: Bear in mind, that after unsticking the pedal loads may decrease. If bank is not applied to the side of the operating engines, there may appear negligible reverse pedal loads which disappear with an increase in flight speed. Do not decrease the deflection of the rudder with a fall in pedal load.

4. If an engine fails at a speed of 170-200 km.p.h. or at a higher speed and, especially, if the captain is not sure that the runway is great enough to interrupt take-off, or if the runway is wet or icy, continue the take-off with three engines operating.

5. If an engine fails after unsticking (at any speed), the flight crew must proceed as follows:

a) The captain removes the tendency of the aircraft to turn and roll by applying the rudder and ailerons. If necessary, a bank of 3-6 deg. is made to the side opposite the failed engine.

b) At take-off, the flight engineer keeps close observation on the engine group instruments and informs the captain of failure. If autofeathering does not work, the engineer immediately feathers the failed engine by pressing the button **KOL-37** or **KU-5** at the command of the captain and closes the stop-cock and fuel shutoff valve.

c) Having pressed the button, use the emergency feathering system to ensure that the feathering has taken place.

d) Retract the undercarriage at a speed of 250 km.p.h. and

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at an altitude of not less than 5 metres.

e) Make the aircraft climb.

f) Retract the flaps at an altitude of not less than 50 metres after clearing all the obstacles. At a speed of 300 km.p.h. apply the trim-tabs and set the engines at nominal rating.

g) If a higher flight altitude is needed, climb at 300 km.p.h. C.A.S.

h) Continue flight according to instructions of a Ground Control Station.

Take-off distance to 15 metres with engine failure after unsticking at 230 km.p.h., is 2,300 metres.

3. CLIMB, LEVEL FLIGHT AND DESCENT WITH ENGINE FAILURE

1. If the flight crew is sure that an engine failed (see Section 1 "Main Indications of Engine Failure in Flight"), proceed as follows:

a) The captain removes the tendency of the aircraft to turn and roll and simultaneously, makes the aircraft bank by 5-6 deg. to the side opposite the failed engine.

b) The flight engineer finds out which engine failed according to readings of the engine instruments and at the command of the captain feathers the propeller of this engine by pressing the button R-37 or J-3.

c) After pressing the button R-37 use the emergency feathering system. Pull the stick as far as it will go (applying a force of about 50 kg) and leave it in this position till the end of flight.

d) After feathering the captain applies the trim tabs, and the flight engineer closes the fuel shut-off cock, engine stop-cock and oil cooler shutters.

e) Min. permissible speed with three engines operating is 350 km.p.h., CAS. In rough air speed should be increased up to

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380 km.p.h.

If it is impossible to maintain this speed without loss of altitude then descend till the level flight speed of 350 km.p.h., CAS, is achieved (or respectively, 380 km.p.h. in rough air).

2. In extreme cases, when propeller blades take the fine pitch as a result of a failed propeller control system of an operating engine, the aircraft achieves rapidly high angles of roll and turns sharply in the direction of the defective power plant. If shortage of time, especially in descent, precludes finding out which of the two engines failed, the crew must feather both propellers on the wing, in the direction of which the aircraft turns.

3. It is recommended to climb if necessary, without bank or with a bank of 1-2 deg. to the side opposite the failed engine, in practice, bank within 2 deg. to this side has no effect upon rate of climb.

4. In practice, min fuel consumption per kilometer with three engines operative does not differ from fuel consumption under normal flight conditions at equal weights and altitudes.

5. Watch that fuel in flight is consumed evenly from both wings fuel tanks, fuel load in one wing does not exceed fuel load in the other wing by more than 600 kg.

6. Descend with one engine inoperative as under normal conditions.

4. LANDING WITH ONE ENGINE INOPERATIVE

1. Make an approach to land as if under normal conditions with all engines operating.

2. Speeds for lowering undercarriage and flaps are the same as under normal conditions. In descent, after the 4th turn, return the rudder-and-aileron trim-tabs back to "Zero" position.

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3. Engines run as under normal flight conditions. Position of the fuel control lever position indicator must be higher by 5 mm. for the engine adjacent to the inoperative engine.

4. Landing (touch-down) with three engines operating is performed as landing with four engines.

5. After touch-down, set the control levers according to "Ground-Idling" and remove the propeller stops of two inoperative engines operative, keeping the direction of the aircraft constant by the rudder and brakes. At a run speed of 70-80 km.p.h., remove the propeller stop of the third engine.

6. Steer, if necessary, the nose gear to keep the direction of run.

7. A missed-approach action is taken as with four engines operating.

5. FLIGHT WITH TWO ENGINES INOPERATIVE

1. If in flight with one engine inoperative the second engine fails, the flight engineer must feather at the controls of the captain the propeller of this engine as he did with the first engine, and close the stop-cock and engine fuel shutoff valve.

2. Apply the trim-tabs, run the engines as necessary, trim and continue flight to the nearest airfield. The aircraft is easily trimmed during flight with two engines inoperative on one wing.

3. In the event of failure of the second engine in level flight at an altitude of 8,000-10,000 metres, CAS must be 320-330 km.p.h. (360 km.p.h. in rough air). At this speed the aircraft will lose height, vertical descent speed decreasing gradually, and then will resume horizontal flight. Altitude of flight will increase later, as fuel is consumed.

4. During flight with two inoperative engines the pilot must watch that fuel is consumed evenly from both wings.

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difference in fuel quantity must not exceed 600 kg.

5. In flight with two engines inoperative, air tapped from the operating engines to pressurize the cabin, is doubled. This is extremely unfavourable for engine reliability at altitudes of more than 5,000 metres.

Therefore, flight with two engines inoperative at 5,000metres may be continued at the command of the captain in case of utter necessity only.

**6. LANDING WITH TWO ENGINES INOPERATIVE ON ONE WING.
(PROPELLERS OF THE INOPERATIVE ENGINES ARE
FEATHERED)**

1. Approach may be made with a turn in the direction of the operating engines as well as in the direction of the inoperative engines, a bank being not more than 15 deg.

It is desirable to approach with turns in the direction of the operating engines.

2. Approach to land under conditions recommended for normal gliding and approaching.

3. Keep close observation on a glide speed. It must be 260-270 km.p.h., depending on landing weight.

4. Remove the aircraft tendency to turn in the direction of the inoperative engines by applying bank and by pushing the rudder control pedal. Keep close observation on the slide indicator; sliding should not be high.

5. In the event of landing with two inoperative engines on the same side, pedal loads be not exceed 40-50 kg and aileron control wheel load be not exceed 15-20 kg till touch-down. After the fourth turn in glide, disbalance gradually the aircraft by the rudder trim-tab so that at a moment of flying above the near side landing gear, the trim-tab will be in the "zero" position.

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Set the aileron trim-tab in the "zero" position after the fourth turn.

6. There must be no sideslip at the moment of final approach and touch-down. The control levers of the operating engines must be set not less than 25-20 deg on the fuel control lever position indicator.

7. After the touch down, the inboard operating engine is set at "Ground-Idling" and the propeller stop of this engine is removed at the command of the captain.

8. During the landing run the captain must ensure that the direction of run is correct and then command to set the outboard engine at "Ground-Idling".

IT IS FORBIDDEN TO REMOVE THE PROPELLER STOP OF THE OUTBOARD ENGINE ABOVE 100 km.p.h.

Remove the propeller stop of the outboard engine at a speed of 50-60 km.p.h.

9. If necessary, steer the nose wheel throughout the landing run.

10. Glide and landing with two inoperative engines on different sides of the wing are made, in general, in compliance with the recommendations for glide and landing with 4 operating engines. In the event of failure of two inboard engines, bear in mind that the hydraulic pumps are inoperative and it is necessary to act in accordance with the recommendations on page of these Instructions.

11. A missed-approach action is possible to take from an altitude of not less than 50 m.

12. Extension of flaps during undershooting and overshooting complicates piloting of the aircraft. Flaps are extended by 15 deg after the fourth turn if the captain is sure that the calculation

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is correct. Before flaring-out, the flaps are down by 30 or 40 deg. depending upon the allowances made in calculations.

7. FLIGHT AND LANDING WITH AUTOROTATING PROPELLER OF FAILED ENGINE.

In the event of simultaneous failure of the engine and feathering system, the propeller of the failed engine will autorotate, increasing drag.

The flight characteristics of the Il-18 allow to continue flight to the nearest airfield and to land with the autorotating propeller of any engine, provided that the flight crew acts in the right way.

In the event of simultaneous failure of the engine and propeller feathering system, the captain sets the engine adjacent to the failed engine at nominal rating (if necessary, at take-off rating). All evolutions before the flare-out are performed as under normal flight conditions.

Landing speed is recommended to exceed the normal landing speed by 10-15 km.p.h.

Control column and pedal loads at the pre-touch-down stage (at low speed) are as follows:

From elevator	From rudder	From aileron
40 kg	70 kg	15-25 kg

8. EMERGENCY DESCENDING

In the event of a cabin decompression, it is necessary to descend rapidly to an altitude of 4,000 metres. Proceed as follows:

1. Move the engine control levers to the "Ground-idling" stop.

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2. Extend the undercarriage at 350 km.p.h., 611.8. and descend to 4,000 metres.

Mach Number should not exceed 0.65;

C.A.S. should not exceed 610 km.p.h.

3. The flight crew must put on the oxygen masks.

4. After descending to 4,000 m, the captain uses his own discretion to determine further flight conditions.

9. ENGINE START IN FLIGHT

1. In flight, starting of a failed engine is permitted under all conditions.

2. An engine starting in flight is allowed in extreme cases only, when, for instance, the engine is quite in order and has stopped by mistake of the flight crew or for some other reason which cannot lead to its failure.

In such cases, an engine is allowed to start up to 5,000 metres provided the captain has been specially trained to start the AI-30 engines in flight. CAS must be as follows:

Altitude, metres	2,000	5,000	8,000
CAS km.p.h.	410	340	280

During an engine starting at these flight altitudes, vibrations of the aircraft and negative thrust, resulting in the of engine unfeathering, are near minimum.

Above 5,000 metres it is not recommended to start an engine because of possible rise in r.p.m. above the permissible limits.

3. Before start:

a) The engine control lever must be set at 0 deg on the fuel control lever position indicator (Ground-Idling).

b) The fuel shutoff valve must be opened.

C H A P T E R 14

OPERATING THE AIRCRAFT SYSTEMS IN FLIGHT

I. LANDING GEAR AND HYDRAULIC-EXTENSION SYSTEMRetracting the L.G. in flight

To retract the L.G., proceed as follows:

- a) throw the guard cap on the L.G. extension button;
- b) press the L.G. retraction button for 1-2 sec., the upper "L.G. energized" light should come on; release the button and make sure that the light is on;
- c) check the L.G. retraction by observing the L.G. position indicators and warning lights.

After the L.G. retraction is accomplished be sure that:

- the L.G. position indicator pointers are in the "Up" position;
- all the three red "Up" position warning lights are on;
- nose leg mechanical position indicator is retracted;
- the upper "L.G. energized" light has gone out and the retraction button popped out.

CARETION: If the "L.G. energized" light does not go out or the retraction button fails to pop out, pull out the button by the finger.

Extending the L.G. in flight

To extend the L.G., proceed as follows:

- a) throw the guard cap on the L.G. extension button;
- b) press the L.G. extension button for 1-2 sec., the lower "L.G. energized" light should come on; release the button and

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make sure that the "L.G. energized" light is on;

c) check the L.G. extension by observing the L.G. position indicators and warning lights.

After the L.G. extension is accomplished make sure that:

- the L.G. position indicators pointers are at "Down";
- all the three green L.G. "Down" warning lights are on;
- the green "Parking brake released" light sign is on;
- pressure indicated by the "Parking brake" electric pressure

gauge is 0.

- the nose L.G. mechanical position indicator is fully extended;

- the "lower" "L.G. energized" light is out and the extension button has popped out.

Emergency L.G. Extension in Flight

If the L.G. fails to be extended by the main hydraulic system, perform the emergency extension of the landing gear.

To do this, proceed as follows:

- turn the L.G. emergency extension control lever fully up and make sure that it is locked in this position.

- check the L.G. extension by the L.G. position indicators and warning lights.

After extending the L.G., be sure that all the warning devices are in the position indicated in the "Extending the L.G. in flight" section.

Flying speed, during the L.G. extension should be 330-350 km/hr. After the L.G. emergency extension the L.G. doors are left open.

If one of L.G. legs is not secured by the down lock force it to lock increasing the flight speed above 350 km./hr. but not exceeding 400 km./hr.

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NOTE: 1. After the L.G. emergency extension leave the emergency extension control lever in the upper position till the L.G. inspection on the ground.

2. During training flights, after the L.G. emergency extension it is permitted to return the L.G. emergency extension lever to the initial position, with the main system in reliable condition.

Nose L.G. Steering Control

It is permitted to switch on the nose L.G. control, with the aircraft moving on the ground at a speed not exceeding 100 km./hr. When retracting the L.G., the nose L.G. steering control is automatically switched off when the nose L.G. starts retracting. With the nose L.G. shock strut not compressed, the wheels and the nose L.G. steering control wheel should be automatically set in neutral or almost neutral position.

To switch on the nose L.G. steering control, set the switch in the "ON" position. The red "Nose L.G. steer. control on" light should become illuminated.

To switch off the nose L.G. control, set the switch in the "OFF" position. The red "Nose L.G. steer. control on" light should go out.

CAUTION: At sharp turns when the aircraft moves on the ground at a speed exceeding 20 km./hr., the steering control may become heavy and the nose L.G. steering control wheel tears away from the pilot's hands. To facilitate the aircraft turn, apply the wheel brakes, observing the permissible radius of the aircraft turn.

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USING THE WINDSCREEN WIPERS

To switch on the windscreen wipers, turn the FA-171 windscreen wiper control valve to the open position. The windscreen wiper blade movement speed depends on the valve opening.

The wiper blade max. speed (about 200 double travel per min) is obtained with the valve fully opened.

To switch off the operating windscreen wiper, gradually closing the control valve decrease the wiper blade speed to the min. and, with the blade in the vertical position, quickly close the valve.

CAUTION: The windscreen wiper blade is permitted to make not more than 10 double travels on the dry windscreen.

OPERATING THE WHEEL BRAKING SYSTEM

The aircraft is fitted with three braking systems: main, emergency and parking.

The first two systems are designed for stopping the aircraft during landing run; the third system - for braking the wheels when the aircraft is parked.

The main braking system serves as operating braking system of the main L.G. wheels and the emergency braking system is an auxiliary system designed for using only with the main braking system inoperative.

The min. landing run on any runway is achieved by applying the main L.G. wheels brakes with the propellers reversible and with the anti-skid control on.

At all other types of braking the aircraft landing run is longer.

Normal braking can be accomplished both by the pilot and the

co-pilot. When transferring the main braking system control from one pilot to the other, the latter should energetically press the brake control pedals to actuate the brake control selector switches.

WARNING: The simultaneous wheels braking by the main and emergency systems and the wheels braking from the main system simultaneously by the pilot and co-pilot is not permitted.

When applying the brakes, check the pressure in the brake hydraulic accumulators. The normal pressure should be 225-148 kg./cm². At a pressure of 65-70 kg./cm² the hydraulic accumulators are fully discharged and the main braking system does not operate.

With the wheels fully braked the brake pressure should be 65-70 kg./cm².

The rear wheels of each main L.G. bogie are fitted with skid detectors which prevent the aircraft wheels skidding.

When the skid detector of the outboard (inboard) wheel is actuated the pressure drops in the outboard (inboard) wheels of both the L.G. bogies. The "Anti-skid control" switch should be "ON".

At landing, when the aircraft starts rolling on the ground, brake by using the propellers reverse thrust and during the second half of the landing run at a speed not more than 170km/hr. apply the wheel brakes.

In emergency it is permitted to apply the wheel brakes at a greater speed immediately after releasing the propellers pitch stops.

WARNING: Never perform subsequent takes-off and landings of the aircraft without cooling the wheels with brakes fully after making every landing.

To facilitate the wheels cooling, it is permitted to pour water on them.

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USING THE PARKING BRAKE

1. To apply the parking brake, set its switch in the "Braked" position. The green "Parking brake ON" light sign goes out, the pressure by the parking brake pressure gauge is increased to 42-60 kg./cm.² and the main braking system is switched off.

2. To release the parking brake, set its switch in the "Released" position. The green "Parking brakes released" light sign comes on, the pressure by the parking pressure gauge is decreased to zero and the main braking system is switched on. With the brake control pedals pressed - the wheels are braked by the main system.

3. To release the parking brake, with the engines running, first fully press both the brake control pedals, and then release the parking brake as shown in paragraph 2.

WARNING: Do not apply the parking brake at a pressure in the hydraulic accumulators below 80 kg./cm.²

OPERATING THE EMERGENCY BRAKING SYSTEM

If the main braking system fails, use the emergency wheel braking system. To brake, press the lever of the emergency braking valve installed on the centre control pedestal. With the rudder control pedals in the neutral position and the emergency braking valve lever pressed, all the wheels of the right and left L.G. bogies are braked. To brake the wheels of the right and left bogies separately, move the respective pedal with the valve lever pressed. When moving forward the right pedal the wheels of the left bogie are released and the aircraft turns to the right, and when moving the left pedal forward - vice versa.

Difference in braking value of the wheels of the right and left bogies is approximately proportional to the pedals movement from their neutral position.

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To reliably change over to the emergency braking system, first fully press the emergency braking lever, the rudder control pedals should be in almost neutral position.

Further application of the emergency braking system depends on required braking value, the airfield surface and load on the wheels. The emergency braking system is not provided with anti-skid control.

When using the emergency braking system, brake smoothly avoiding unnecessary releasing of the brakes as it can result in quick consumption of compressed nitrogen from the emergency braking system bottle.

To release the wheels brakes of both the L.C. bogies, release the emergency braking valve control lever.

WARNING: When using the emergency braking system, neither press the main braking system control pedals nor apply the parking brake.

The pressure in the emergency braking system bottles should be 120-150 kg./cm². Max. pressure in the wheels brakes with the emergency braking valve lever fully pressed should be 75-85 kg./cm².

OPERATING THE HYDRAULIC SYSTEM WITH TWO INBOARD ENGINES FAILED

If two inboard engines fail proceed as follows (before landing and during landing):

- a) perform the L.C. emergency extension;
- b) set the anti-skid control switch in the "OFF" position;
- c) make sure that the nose L.C. steering control switch is set in the "OFF" position;
- d) when braking the wheels, bear in mind that the anti-skid controls are off and the pressure in the brakes hydraulic accumulators may be insufficient for braking;

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e) if the pressure in the brake system hydraulic accumulator is insufficient, brake the wheels by the emergency braking system.

CAUTION: When landing, at a side wind, it is not permitted to counteract the aircraft deviation by steering the nose L.G. as it is not controllable.

NORMAL READINGS OF THE HYDRAULIC SYSTEM INDICATORS IN FLIGHT

1. In flight periodically check the pressure in the "Main system" hydraulic accumulator by the electric pressure gauge and the PA12FM pump relief valve actuation frequency indicated by the pump operation blue warning light coming on.

At the hydraulic system normal operation these lights should come on not more than once every 30 min.

2. In flight the readings of the pressure gauges on the pilot's control panel should be as follows:

- 3M-220 pressure gauges of "Main system" and "Brakes" hydraulic accumulators $160 \pm 12 - 210 \pm 15$ kg./cm²
- 3M-80 pressure gauges "Parking brake", "Right brake", "Left brake" 0 kg./cm²
- 3M-150 pressure gauge of emergency brake system bottle 160-110 kg./cm²
- 3M-80 pressure gauge of emergency feathering system bottle 20-60 kg./cm²

3. Normal L.G. retraction time. 16-20 sec.

Normal L.G. extension time 11-14 sec.

When the L.G. is operated from one pump, the retraction time is increased approximately twice, the extension time does not change practically.

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2. F L A P S

To extend or retract the flaps, set the flap control lever in the corresponding position.

When extending the flaps, the pilot must be very attentive. If during the flaps extension the aircraft starts to bank, he must immediately, without wasting time on detecting the cause of bank, set the flap control lever in the "Retraction" position and hold the aircraft with the flaps up.

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3. CABIN AIR SYSTEM AND OXYGEN EQUIPMENT

CABIN AIR SYSTEM EQUIPMENT

Before take-off. 1. See that before starting the engines, air bleed supply from the engines to the cabin is out off, in this case the red lights (18, 19 Fig. 6) are on and the selector switches (13 and 14) are in "Off" position.

2. To speed the cabins heating or cooling, manually hold the selector switches (15, 16 and 17) in the "Hot" position in winter and in the "Cold" position in summer for 25-30 sec., before setting them in the "Automatic temperature control" position.

3. Set the air temperature preset unit (11) of the individual ventilation system for a temperature of 15-17°C.

4. Set the "Pressurization - Decompression" selector switch (7) in the "Pressurization" position.

5. Close the cockpit windscreen blast hot air shutter.

6. Set the TPTBK-43M cabin thermostat scales of the cockpit and passenger cabin for a temperature of 20°C.

In flight. 1. Turn on air supply from the engines to the cabin after take-off at a flight altitude of 200-400 m. and 270-300 km./hr. I.A.S. To do this, set the selector switches (13 and 14) in the "Air bleed from engines" position. The red lights (18 and 19) go out.

2. Air flow meters (12) readings should be within 3.6-5.2. With increase in altitude, air flow decreases within the specified limits.

3. If air flow indicated by the flow meter (12) exceeds 3.6, detect a failed 503B absolute pressure limiter by switching on the air supply from the right and left engines in turn and provide air supply from the operating 503B unit. In this case descend to an altitude not exceeding 5,000 m.

4. Temperature control in the cabins is accomplished automatically since take-off, i.e. the selector switches (15, 16, 17) must be set in the "Automatic temperature control" position.

Check the automatic temperature control in the cabins by observing the readings of the indicators (3 and 4).

The automatic temperature control results in the following temperature variation:

- from 15 to 25°C in the cabins (by indicators 3 and 4);
- from 20 to 115°C in the system (by indicators 9 and 10).

If necessary, it is permitted to change the preset temperature by the TPTRK-45 M thermostat.

5. If the automatic temperature control fails to operate, turn over for manual regulation without permitting an increase in the temperature.

a) of supplied air above 115°C (by indicators 9 and 10). In this case the "Dangerous overheating" red warning lights (20 and 21) come on.

NOTE: Momentary temperature increase up to 135°C for not more than 3 min. due to the thermostat inaccuracy is permitted.

b) above 25°C in the individual ventilation line (by indicator 5). Check the air temperature in the passenger cabin and cockpit by observing the readings of the indicators (3 and 4).

6. Prevent increase in the temperature of air supplied for the windscreen blasting above 100°C by reading the indicator (2) and regulate the air temperature by the shutter controlled from the right console.

7. The "Preset temperature" green signal light (22) should be constantly illuminated at the preset temperature and reliable operation of the PTA-16-6 automatic temperature regulator. With the temperature changed by the preset unit (11) the light goes out and after the PTA-16-6 has completed its operating cycle the light comes on again.

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Until the temperature reaches the preset value the light blinking is permitted.

CAUTION: If the green light is off for 3 min. check the air temperature by the indicator (5) and if the temperature does not correspond to the temperature preset by the unit (11), change over to manual temperature control. The temperature indicated by the indicator (5) should not be below $+5^{\circ}\text{C}$.

8. If smoke or smell of burning appears from the heating and ventilating nozzles cut out air supply from the engines and descend immediately.

9. When flying at an altitude of more than 4.4-5.5 km., the 469 cabin air pressure regulator automatically maintains in the cabin differential pressure of 0.48-0.52 kg./cm² checked by the YBIM-20 cabin altitude and differential pressure indicator. A 1,700-1,300 m. cabin altitude is maintained at a flight altitude of 8,000 m.

10. When the aircraft carries passengers, the rate of the pressurized cabin altitude change should not exceed 2-3 m/sec, which corresponds to 0.18 mm Hg/sec. change in the cabin pressure. Check the above values by the cabin rate-of-climb indicator readings.

11. Never set the "Pressurization - Decompression" selector switch in the "Decompression" position in flight.

WARNING: If the cabin differential pressure increases to 0.55 kg./cm², cut off air supply to the cabin and descend to an altitude of 4,000 m.

12. With the "Dangerous decompression" light panel on, check by the cabin rate-of-climb indicator and YBIM-20 cabin altitude and differential pressure indicator if the cabin is actually decompressed or the light panel is illuminated due to overpressure.

altitude preset on the BC-46 altitude switch. (The altitude switch should be preset for an altitude of 3,000 m.).

In case of the cabin decompression immediately descend.

13. Turn out the pressurization, heating and ventilation system during the aircraft landing approach at 4000-6000 m. altitude. To do this, set the selector switches (13, 14) in the "Off" position.

14. To quickly equalize the cabin and outside air pressures, after landing, it is permitted to set the "Pressurization-Decompression" selector switch in the "Decompression" position.

OXYGEN EQUIPMENT

The pilot and co-pilot are provided with KI-24M oxygen regulators, the other crew members - with KI-32 oxygen regulators and the passengers - with KI-21 oxygen regulators. The KI-32 oxygen regulator is adjusted for initial oxygen supply at flight altitude exceeding the pressurized cabin altitude, which prevents oxygen flow from the regulator to the mask. Therefore, to use oxygen in normal flight, switch on oxygen supply by the manual control valve on the KI-32 oxygen regulator.

The portable KI-21 oxygen regulator is intended for use by the passengers and is given to them in flight by the stewardess, if necessary. The KI-21 oxygen regulator is used similar to the KI-32 regulator in the pressurized cabin by means of the manual control valve. Oxygen supply is switched on by turning the valve counterclockwise (pressure indicated by the pressure gauge is 0.8-1.5 kg./cm²).

The KI-16M mask is used with the KI-24M oxygen regulator, used with the KI-32 and KI-21 are open-type masks KI-19 or KI-4M which are not to be tightly fitted to the face. The mask is connected to the indicator through the rubber pipe connection, and when using the oxygen.

1728 litres of oxygen contained in two 36-litre bottles under a pressure of 30 kg./cm² provide one pilot for 9 hours of flight in the pressurized cabin and the other four crew members for 9 min. in the unpressurized cabin. Oxygen quantity provides one pilot in the pressurized cabin with oxygen for 5 hours of flight and the other crew members for 1 hour.

The 1.7-litre capacity KL-21 portable oxygen regulator can be used in the pressurized cabin for 12-15 min.

The portable oxygen regulators bottles are charged with medical gaseous oxygen, Sort "A" (ГОСТ 5583-50), up to a pressure of 30 kg./cm² at +15°C.

The fixed oxygen bottles and the portable bottles are charged only on the ground from the KDC oxygen supply cart or from ground oxygen cylinders. In flight, after climbing to an altitude of 4,000 m. the pilot himself or the co-pilot by the pilot's command puts on the oxygen mask and during the whole flight till the aircraft descends to an altitude of 4,000 m. one of the pilots controls the aircraft with the mask on his face. Should the cockpit sudden decompression occur he must quickly descend the aircraft to a safe altitude. In this case, the other crew members can quickly use oxygen. The pilot and co-pilot must periodically check up oxygen flow to the masks by observing the indicators. The co-pilot checks the oxygen reserve by the pressure gauge. It is necessary to bear in mind that the regulators do not operate at an oxygen pressure below 6 kg./cm².

If the pilot breathes with difficulty or feels bad, when using the oxygen, it is necessary to switch on the KL-24M oxygen regulator emergency supply and to cut off air dilution if smoke gets into the cockpit.

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NOTE: To use oxygen in the pressurized cabin, operate the KIL-32 oxygen regulator manual control valve to build up in the supply line an oxygen pressure of 0.8-1.5 kg./cm² indicated by the MT-60 pressure gauge; this corresponds to the oxygen supply at an altitude of 2,500-3,500 m. Oxygen flow to the mask is indicated by the float rising in the transparent part of the oxygen flow indicator.

The stewardess must provide oxygen supply from portable oxygen bottles for the passengers if the latter feel the necessity of using the oxygen.

The stewardess must give the passenger the oxygen regulator, open the valve, check by the pressure gauge that the bottle is charged with oxygen, connect the mask hose connection to the regulator, help the passenger to put the mask on and turn on oxygen supply by the manual control valve. Explain to the passenger in short how to use the oxygen regulator. Periodically check oxygen flow from the bottle by observing the pressure gauge reading on the regulator. The oxygen regulator does not operate at an oxygen pressure below 6 kg./cm². After the passenger stops using the oxygen regulator or oxygen from the bottle is consumed, the stewardess must close the regulator valve, take off the mask from the passenger and install the oxygen regulator in its place.

WARNING: When the crew members or passengers are using the oxygen regulators no smoking is permitted.

4. DE-ICING SYSTEM

During all flights in clouds at outside air temperatures below zero, the de-icers of the engines, engine air intakes and propellers must be constantly switched on. Switch on the de-icers before entering clouds and switch them off after leaving the clouds.

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Switch on the de-icers of the wing and tail unit after the "Icing" light sign has become illuminated (the ice detectors are actuated) or when ice appears on the ice formation indicators, and switch off the de-icers when the "Icing" light sign goes out or no icing is evident.

Check operation of the wing, tail unit and propeller de-icers by blinking of the indicator lights on the de-icer system panel and indications of the d.c. ammeters on the radio operator's switch panel.

With the wing and tail unit de-icers operating, the d.c. ammeters should read about 1,800 A greater current.

When the propeller de-icers are on, the d.c. ammeters of the 1-st and 3-rd CTO-8 alternators should read 60-70A.

NOTE: The aircraft electrical system does not ensure operation of the propeller de-icers under the following conditions:

- de-icer of the first engine propeller - when its CTO-8 alternator and the fourth engine or its CTO-8 alternator fail at the same time;
- de-icer of the second engine propeller - when the first and fourth engines or their CTO-8 alternators fail at the same time
- de-icers of the third engine propeller - when its CTO-8 alternator and the fourth engine or its CTO-8 fail at the same time;
- de-icers of the fourth engine propeller - when its CTO-8 alternator and the third engine or its CTO-8 alternator fail at the same time.

In these cases the pilot should leave the icing zone.

CAUTION: Do not energize the wing and tail unit de-icers in flight under no icing conditions. The de-icers are allowed to be energized for test purposes only 20 to 30 min prior to landing for 8 minutes maximum.

5. FIRE EXTINGUISHING SYSTEM

If a fire is detected in the engine compartments by illumination of the light sign or the horn sound, or when a fire is discovered visually, do as follows:

1. When the light sign comes on or the horn begins sounding, proceed with the following instructions:

a) Feather the propeller of the engine on fire by pushing the button on the centre control pedestal and simultaneously operating the emergency feathering handle on the cockpit floor.

b) If the fire extinguishers of the first group are not actuated automatically (the green light indicating the valve opening has not lighted up), actuate the fire extinguishers of the first group by turning on the corresponding switch on the fire extinguishing system control panel. In this case the green lamp will light up indicating that the extinguishant supply valves are open;

c) Put the engine-on-fire switch on the centre control pedestal in the "Stop" position;

d) Close the fuel shut-off valve of the defective engine;

e) attentively observe the light sign: if the light sign goes out after 6 sec., it indicates that the fire is extinguished by the first group fire extinguishers. If the light sign keeps on six minutes after the green lamp has lighted up, actuate the second group fire extinguishers by operating the corresponding switch on the fire extinguishing system control panel.

2. If a fire is discovered visually, actuate the first-group fire extinguishers and in 6 sec. actuate the second-group fire extinguishers by operating the corresponding switches without waiting for a fire alarm signal.

WARNING: If the green lamp is not lighted up after the first-group fire extinguishers have been actuated (the distributing valves fail to operate), actuate the second-group fire extinguishers.

When a fire on the engine is detected, the pilot must perform an emergency descent and descend to a minimum safe altitude depending on weather conditions and terrain, and at that altitude approach the nearest airfield for landing.

If the fire is not extinguished by the first extinguishing system operation, the pilot, after the emergency descent, must perform a forced landing with the L.G. retracted.

Before a forced landing with the landing gear retracted, close the fuel shut-off valves of all the four engines and disconnect all the electric power supply sources.

To extinguish a fire in the cabins use the portable fire extinguishers provided at the forward and rear entrance ramps.

3. In case of propeller self-feathering the flight engineer by the pilot's command must immediately switch ON the first group fire extinguishers for the engine on fire and close the fuel shut-off valve of this engine. If after this fire signs are evident, actuate the fire extinguishers of the second group.

After the propeller self-feathering the pilot should adhere to the instructions outlined under step 2.

6. FUEL SYSTEM

FUELLING THE AIRCRAFT

GENERAL

Use T-1 (POCT 4138-40), TC-1 (POCT 7149-34) kerosene as fuel for the engines. To prevent freezing of the fuel filters and ice formation at an outside air temperature below -5°C use frost-treated fuel or add "N" fluid to the fuel according to the Instructions for "N" fluid storage and use to preclude ice crystals formation in fuel used for gas-turbine engines.

PREPARATION FOR FUELLING

1. Prior to fuelling the flight engineer must check the sediment drained from a fueller tank sump for freedom from water and

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foreign matter, check the fuel certificate, condition of the seal on the fueller and cleanliness of the gauze filter in the hose discharge cock.

2. The fueller, hose discharge cock, hoses and the aircraft must be grounded.

FUELLING

Fuel tanks capacity:

Main tank group 8,200 litres (6315 kg.) ; , , litres (2,540 kg.) of this quantity in tank No.8 and 800 to 200 litres (690 kg.) in service tanks No. 1 and 3.

Auxiliary group 1 3,550 litres (2,810 kg.)
 Fuel quantity in fuelling ... 11,859 litres (9,125 kg.)
 Total fuel quantity in aircraft.. 23,700 litres (18,250 kg.)

Fuel specific weight $\gamma = 0.770$

NOTE: Specified above is the useful capacity of the tanks filled up to the edge of the filler necks.

When using fuel of another specific gravity, consider fuel quantity changing (in kg.) in conformity with the new specific gravity.

When fuelling the tanks through the six upper filler necks (three filler necks on each wing), check the fuel tank vent pipes outlets and filler neck funnels for cleanliness.

When using hose discharge cock, fill the tanks with fuel through gauzes in the filler necks.

The flight engineer, by the pilot's order, gives directions for fuelling procedure and quantity of fuel with which the aircraft tanks should be filled in any particular case.

The quantity of fuel the tanks are to be filled with is determined according to a flight mission and the aircraft weight and balance data.

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When fuelling the tanks partially, begin with the first group tanks, filling them through the filler neck of tank No.3, then through the filler neck of tank No.6 and after this fill the tanks of the auxiliary (second) group.

The fuel quantity is checked by means of the fuel contents gauge in the cockpit, fuel flowmeters of the fueller and dip sticks located at each filler neck of the tanks.

To prevent overflowing of the tanks when filling them up to full capacity leave a space volume for fuel expansion maintaining a fuel level of 30 to 40 mm. below the edge of the filler neck. The tanks No.8 must be filled with fuel up to the filler neck edge, a space volume of 60 litres being reserved for fuel expansion in this case.

Pressure fuelling of the tanks from underneath is accomplished through the two filler necks installed on the starboard of the inboard engine nacelles in the wheel wells.

After the fueller hose and connections have been attached to the filler necks proceed as follows:

- a) set the fuel contents gauge switch in the cockpit in the "Pressure fuelling" position;
- b) set the master switch on the pressure fuelling control panel in the engine nacelle to the "Supply" position. In this case the red lights "Fuelling valves closed" become illuminated.

WARNING: Prior to fuelling switch off the circuit breakers (on the navigator's switch panel) controlling the automatic fuel transfer from the auxiliary group of the tanks.

- c) Check the quantity of fuel in the tanks by observing the readings of the fuel contents gauge indicators on the fuelling control panels;

d) Operating the switches on the fuelling control panel, open the fuelling valves of the group of the tanks to be filled (the green lights are ON) and start fuelling the tanks.

The fuelling is stopped automatically when the tanks are filled up. The fuel contents gauge level switches along the fuelling valves (the red lights come ON).

NOTE: At the end of filling No. 1 through No. 7 tanks of the first-group, the green lights are permitted to blink 3 to 4 times with 30-second intervals.

When fuelling the tanks partially, close the fuelling valves by the switches.

After the fuelling has been completed do as follows:

- a) set the valve control switches to the "Valves closed" position;
- b) turn the master "Supply" switch OFF;
- c) switch the fueller pumps over to operation and bypass feed from the fuelling pipeline;
- d) set the fuel contents gauge switch in the cockpit to the "Read in cabin" position and check the quantity of fuel in all the tanks.

NOTE: When pressure fuelling the tanks up to full capacity the total quantity of fuel in the tanks is 1,200 to 1,300 litres (770 to 1,000 kg.) less than when fuelling through the upper filler necks. When it is required to fill the tanks up to capacity, replenish them through the upper filler necks.

WARNING: Since the aircraft fuelling is disconnected with the fuel contents gauges and automatic fuelling valve closing control system operation, i.e., the aircraft is energized, take the necessary fire-protection measures according to the instructions.

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After the fuelling has been completed check the filler necks for proper tightening and locking, and 10 or 15 minutes after fuelling, check the sediment drained from each group of the tanks.

INSTRUCTIONS FOR OPERATING THE AIRCRAFT FUEL SYSTEM IN FLIGHT

1. Four fuel booster pumps (two in the left wing and two in the right wing) are set in operation prior to starting the engines, are operating all the time of the flight and stopped after the engines stopping.

When fuel from the tanks of the second group is consumed, start the pumps transferring fuel from tank No.2 to the service tanks to maintain a maximum fuel level in the service tanks. If the second-group tanks were not fuelled, then start the pumps transferring fuel from tank No.2 on the ground simultaneously with the booster pumps.

During the fuel transfer the green lights located at the pump switches are on. At the end of a flight stop the pumps manually after the fuel transfer has been completed (when the green lights at the switches go out).

In normal flight, the fuel, as a rule, is not consumed completely.

2. Fuel supply from the tanks of the two main groups does not require any control in flight. Fuel from the tanks of the two auxiliary groups is transferred into the main tanks automatically.

In case of failure the aircraft crew must take necessary measures, therefore the fuel system instruments and signals must be attentively observed in flight.

Fuel from the tanks of either half wing is used in accordance with the following sequence:

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1. After starting the engines a fuel quantity of 150 - 250 litres is consumed from each first group of the tanks, and then the fuel contents gauge tank unit of tank No.6 automatically switches ON the two pumps transferring fuel from the 2nd auxiliary tanks group. The "Aux. tanks transf." green light sign on the instrument panel becomes illuminated.

After 300-400 litres (333-444 kg.) of fuel has been consumed from the tanks of the first group the float-operated valve in tank No.6 opens and fuel transferring from the second-group tanks begins.

WARNING: If the auxiliary tanks fuel transfer system is not switched ON automatically 10 to 15 minutes after the take-off, start the transfer pumps manually by operating the switches located on the centre control pedestal.

2. When the fuel from the second group tanks has been used completely, the "Aux. tanks transf." light sign goes out, the transfer pumps are automatically stopped and fuel begins to be used from the tanks of the main first group, the process being checked by the fuel contents gauge. Then start the pumps transferring fuel from the tank No.2 to the service tanks.

4 Check operation of the pumps by observing the green light on the centre control pedestal.

During the aircraft maneuvers or in bumpy air the fuel may flow away from the transfer pumps and as a result of this the automatic fuel transfer system would be switched off prematurely (the fuel transfer light sign goes out).

In this case 200 to 400 litres of fuel may remain in the auxiliary tanks.

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To use the fuel completely set the automatic fuel transfer system to the initial position, for which purpose switch off and then on momentarily the automatic fuel transfer system power supply circuit breakers on the navigator's switch panel (the automatic system will start operating again), or start the fuel transfer pumps manually. When the transfer pumps are started manually the "Aux. tanks transf." light sign is OFF, and operation of the fuel transfer system may be checked by the fuel contents gauge indications only.

When the fuel contents gauge reads "0" in the auxiliary group tanks, start the fuel transfer pumps manually.

WARNING: If the transfer pumps were started manually, they must be stopped by means of the switch. When it is required to stop the automatic fuel transfer from the second-group tanks, start the pumps by means of the circuit breakers on the navigator's switch panel.

3. Fuel in wing integral tank No. 8 is held by the float-operated valve until the fuel quantity in tanks Nos. 1 through 7 reaches 3,600 litres⁺²⁰⁰₋₁₀₀ (2,800 kg.) and then the fuel begins flowing from tank No. 8 to tank No. 6 (main tanks). When fuel is being consumed from tank No. 8, this level of fuel is maintained by the float-operated valve within the range of 3,600-2,500 litres (2,770-1,925 kg.) depending on the fuel consumption and the aircraft bank. Capacity of either tank No. 8 is 3,300 litres (2,540 kg.).

During this flight stage periodically check the quantity of fuel in tanks No. 8 by the fuel contents gauge to make sure fuel from the tanks is being used.

4. After the fuel from tank No. 8 has been used up, in the main group remains 2,800 to 2,500 litres (2,150 to 1,900 kg.) of fuel which begins to be consumed.

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5. In normal flight the 1-hour fuel reserve is not consumed and therefore the "1,000 kg. fuel reserve" red light sign normally is not illuminated.

When 1,000 to 1,100 kg. of fuel remains in each first-group of tanks of either half wing (2,000 to 2,200 kg.) in flight, the "1,000 - kg. fuel reserve" red light sign on the instrument panel becomes illuminated. When the green lights at the switches (from the QUV-2 pressure switches) are OFF, the quantity of fuel remaining in the service tanks of either half wing is equal to 690 kg. In this case stop the fuel transfer pump by the switches. Check the quantity of fuel in the service tanks by observing the inner scales of the fuel contents gauges. Should the fuel transfer pump fail, the "1,000 kg. fuel reserve" light sign becomes illuminated when the actual fuel reserve is 610 kg. (800 litres).

The cross-feed valve, under normal conditions, is always closed. The R.H. engines are fed from the right group of the tanks, and the L.H. engines are supplied with fuel from the left group of the tanks.

When flying with one or two inoperative engines located in the same half wing, ensure equal consumption of fuel from the right and left groups of the tanks by opening the cross-feed valve and stopping one booster pump in the service tank of the group opposite to that of the failed engine.

To rapidly equalize the fuel quantity in the right and left groups of the tanks it is allowed to stop the two booster pumps of the tank group opposite to that of the failed engine. In this case fuel will be supplied to all the running engines from only one group of the tanks located on the same side with the engines failed.

When flying with two engines failed on the same side, see that fuel is equally consumed from the right and left groups of the tanks and do not permit a difference in quantity of consumed fuel.

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exceeding 500 to 600 kg. (with the cross-feed valve open).

CHECKING THE FUEL SYSTEM OPERATION

1. The fuel system operation is checked by the following instruments located on the instrument panel:

- a) four 3MM-3P unit pressure gauges indicating a fuel pressure upstream of the fuel nozzle. The pressure should not exceed 78 kg./cm.² at take-off rating;
- b) minimum fuel pressure switch (CHY-3 type with an actuating point of 0.35 kg./cm.²) indicating a fuel pressure upstream of the high pressure pump.

When the pressure drops below 0.35 kg./cm.², the "Min. fuel press." red light sign on the instrument panel becomes illuminated;

- c) HHB-2 booster pump failure pressure switches (CHY-2A type with an actuating point of 0.18 kg./cm.²). When two booster pumps of a service tank fail, the "Fuel boost. pump fail" red light sign on the instrument panel lights up.

If the "Min. fuel press." red light sign in this case is not illuminated, the flight may be continued without any decrease in altitude.

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WARNING: If the two light signs "Fuel boost.pump fail." and "Min.fuel press," come on simultaneously, stop the engine and feather the propeller.

d) "Aux.tanks transf." green light sign and CPTC-280 fuel contents gauge check the fuel transfer from the auxiliary tanks group;

e) "1000-kg.fuel reserve" red light sign that comes on when 1,000 to 1,100 kg. of fuel remains in the first-rate tanks. The remaining fuel quantity and transfer are checked by the CPTC-280 fuel gauge;

f) four PTHC fuel flowmeters.

The total fuel consumption counter indicates remaining fuel quantity in kg. per engine. The quantity of fuel consumed by an engine in kg. per hour is read on the hourly-fuel consumption scale; when observing the readings, make corrections according to the calibration charts and corrections for fuel specific gravity in accordance with the fuel flowmeter operation instructions;

g) two CPTC-280 fuel contents gauges having a single switch indicate fuel quantity in the right and left wings respectively. The switch has five positions: total, I gr., II gr., tank No.8 and service tank.

The fuel quantity in the service tank is read on the inner scale of the gauge, and with the switch in any of the other positions, the fuel quantity is read on the outer scale.

2. The following fuel system control switches are located on the centre control pedestal in the cockpit;

- a) four fuel shut-off valve control switches;
- b) cross-feed valve control switch;
- c) four auxiliary tanks fuel transfer manual control switches;
- d) four booster pump control switches;
- e) two switches operating the pumps which transfer fuel from tank No.2 into the service tank and two green indicator lights.

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FUEL DRAIN

1. The fuel is drained from the tanks through four drain cocks, two drain cocks installed in either inboard engine nacelle. The fuel may be drained by gravity or the second group tanks booster pumps and fuel transfer pumps may be set in operation to accelerate the fuel draining.

2. The water is drained through the following drain points:

- a) from tank No.8 - through the drain cocks on the lower surface of the wing, near its attachment joint (2 drain points);
- b) from the booster pumps - through the drain cocks of the IHB-2 pumps (4 drain points);
- c) through the drain cock on the top under tank No.3 and through the drain cocks of the IHB-2 transfer pumps (6 drain points);
- d) from the fuel transfer pipeline - through the cocks of the 2-nd group of the tanks (2 drain points);
- e) from the fuel supply and cross-feed pipelines - through the drain cocks installed on the pipe in the centre wing p.s. section at the fuselage side (2 drain points);
- f) from the fuel filters and engine pipelines - through the drain cocks on the filters (8 drain points);
- g) from the fuel reserve transfer pump of tank No.2 - through the pump drain cocks (2 drain points);
- h) from tank No.1 - through the drain cocks installed on the IHB-2F pumps attachment plates (2 drain points).

In operation, carefully inspect all the connections and attachment joints of the fuel system pipes and hoses for security and proper tightness.

See that the tanks vent line outlets are clean and the vent line safety valves are in proper condition, particularly in winter. See that fuel does not leak from the fuel system vent pipes.

7. OIL SYSTEM

1. For filling the oil tanks use the mixture composed of 75% by volume of transformer oil (FOCT 982-36) or MK-8 oil (FOCT 6457-53) and 25% MC-20 or MK-22 oil (FOCT 1013-49).

NOTE: If necessary, the oil tanks may be filled with the mixture of MK-8 oil and transformer oil and the mixture of MC-20 oil and MK-22 oil in any proportion, but so that the final mixture contains 75% by volume of pure MK-8 oil or transformer oil (or their mixture) and 25% by volume of pure MC-20 oil or MK-22 oil (or their mixture).

2. Before filling, check the oil servicing truck for having a certificate, the oil for being in conformity with the certificate and check the filling hose for cleanliness.

3. The oil tank is filled through its filler neck. Prior to opening the filler neck cap, remove water and dirt from the filler neck sopper.

Fill the oil tank with oil without removing the gauze from the filler neck.

4. The volumetric capacity of the oil tank is 56.5 ± 1 litres. The lower non-measured volume of oil is 15.5 litres, $14^{+0.5}_{-1.0}$ litres of this quantity being used for feathering the propellers and 1.5 ± 0.5 litres of oil remaining in the oil sump. The measured volume of oil in the oil tank is 32 litres.

5. Before a flight over a distance of up to 5,000 km. the oil tank must be filled with 32 litres of oil (as measured by the M C-1897A oil contents gauge in the cockpit, oil contents gauge tank unit scale or by the dip stick).

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If the oil tank has a partition, measure the oil quantity by inserting the dip stick as far as it will go into the filler neck threaded ~~down~~ including the cylindrical portion of the hole fitting, but do not screw the stick in.

WARNING:

1. Fill the tank with 32 litres of oil after testing and stopping the engine on the ground.
2. If the oil tank is filled with 32 litres of oil (as indicated by the oil contents gauge), there should be at least 15 litres of oil in the tank after starting the engine and prior to taxiing out and take-off (not more than 12 litres of oil is permitted to flow into the running engine and not more than 5 litres into the propeller hub).
3. The total quantity of oil flowing into the running engine and propeller hub on the ground and in flight must not exceed 17 litres (oil consumed by the engine in operation not taken into account).
4. The minimum quantity of oil in the tank at which the engine is allowed to run for one hour is indicated by the "5-litre reserve" light sign lighting up. In this case the oil contents gauge should read 5 litres.

WARNING:

When flying with the minimum oil reserve in the tank, observe the oil pressure gauge readings, and in case of pressure dropping below 4 kg. cm², feather the propeller and stop the engine.

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OIL SYSTEM CHECK AND CONTROL

The oil system operation is checked by the following instruments:

1. Installed on the left console in the cockpit are:

- a) two oil contents gauge two-pointer indicators showing an oil quantity in the tanks;
- b) one YIL-4 oil cooler shutter position four-pointer indicator.

2. Installed on the pilots' instrument panel are:

- a) four engine system oil pressure gauges in the 3AM-3P engine gauge units. Oil pressure at all engine ratings at the ground should be 2 to 3.5 kg./cm²; at all ratings at an altitude - not less than 2 kg./cm², including the engine operation at idle speed.

NOTE: When negative loads appear, the oil pressure drops below the minimum permissible value, and the "Min. oil press." light sign becomes illuminated, with the engine operating normally (for aircraft with developed oil systems i.e. with oil tank fitted with a partition, drain tank and MHI -20K oil pump installed on engine).

- b) four engine inlet oil thermometers in the 3AM-3P engine gauge units.

The oil temperature should be as follows:

- recommended - 70° to 80°C;
- minimum - 40°C;
- maximum - 90° - for 15 minutes max.

With the engine running on the ground at an idle speed and 0.2 nominal rating - not more than 100°C for 15 minutes; at this oil temperature take-off is allowed.

- c) two 2AMV-100 two-pointer oil pressure gauges in the engine torquemeter system;

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d) four red light signs controlled by the $Q_{AYC-0.9}$ pressure switches actuated when oil pressure in the engine system drops below 4 kg./cm². (the switch actuating point is 3.5 kg./cm²);

e) four red light signs indicating 5-litre oil reserve in the tank.

3. Four oil cooler shutter control switches are located on the centre control pedestal. The switches have two positions: "Automatic" and "Manual contr."

During engine starting, taxiing and flight the switches must be in the "Automatic" position.

When the automatic oil shutter control system fails to operate, use the manual control maintaining the recommended temperature of the engine inlet oil.

OIL DRAIN FROM OIL SYSTEM

1. Oil from the oil tank, feathering pump and oil cooler is drained through drain cocks.

2. Oil from the engine is drained:

- a) through the drain cock on the front casing;
- b) through the drain plug in the oil unit cover;
- c) through the drain cock on the oil filters in the line of oil scavenge from the middle and rear bearings of the engine rotor.

After draining, close all the drain cocks and plugs. Close the cocks by hand only.

Having closed the drain plugs, lock them.

In operation thoroughly inspect the oil system for tightness, and security of the pipe connections and attachment joints, the tank vent outlets for cleanliness particularly in winter.

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B. INSTRUMENTS AND AL-6E AUTOPILOT

~~Before take-off.~~ 1. Switch on the TL-100 Pilot tubes electric heating irrespective of the outside air temperature and do not switch it off before the aircraft landing.

2. Set the VTK directional gyro indicator scale for the aircraft true heading value (by the VL-1 pilot's indicator).

At the final flight line compare the course indication by the compass system indicator with the direction of the runway and synchronize the readings of the TL-100 autopilot directional gyro with those of the compass system navigator's indicator. Switch the compass system for the directional gyro regime.

USE OF COMPASS SYSTEM AND AL-6E AUTO COMPASS

The compass system is used to determine various, some of the aircraft, relative bearings, true and magnetic bearings, the magnetic declination.

It can be off or switched for the magnetic declination (M.D.), directional gyro regime (D.G.), or magnetic declination and D.G. and gain regime of the compass system according to the TL-100 directional gyro regime.

In the magnetic declination regime (M.D.) and astro correction regime (A.C.) use the quick synchronization method for setting the compass system from the directional gyro regime to magnetic declination regime or astro correction regime of operation, as after the aircraft with bank angle less than 30°.

Switching on the tail rotor protection system, check the compass system from the magnetic declination regime (M.D.) to the directional gyro regime (D.G.) or astro correction regime of operation.

(3X)

a) for occasional true heading reading to check the magnetic heading readings when the compass system operates in the magnetic correction regime, or the present heading when the compass system operates in the directional gyro regime;

b) to constantly obtain the course, when flying the great circle.

3. To occasionally determine the true heading in flight (with the compass system operating in the astro correction regime) proceed as follows:

a) press the "Winding" button on the computer front panel two or three times;

b) set on the computer scales magnetic variation and Greenwich hour angle of the Sun for the present moment of time and the aircraft latitude and longitude;

c) set the "Speed" and "Track" pointers at "Zero" on the Track corrector.

4. To determine the course when flying the great circle with the compass system operating in the astro correction regime (AC), do as follows:

a) before taking-off be sure that the astrocompass is on and press the "Winding" button two or three times;

b) in flight, before passing the initial point of flight (IPF) set the Sun's coordinates (δ , t_{rp}) and the IPF coordinates (φ , λ);

c) when passing the IPF set the rated or measured ground speed values on the track corrector;

d) to fly the established great circle, place the aircraft on the course so that the YIII navigator's indicator reading is equal to the great circle true course angle in the IPF minus the drift angle;

e) further in flight hold the above course periodically checking the drift angle, ground speed and distance from IPF and, ac-

regarding to this, correct the course and the pointers indications on the track corrector;

2) the great circle stage length rated for the instrument is 1,000-1,200 km. therefore, when entering a new stage of the great circle, set the track corrector pointer at zero, determine the new value of the great circle true course angle on the map, set the coordinates of the new IPF on the computer, considering the drift angle, and fly the aircraft on a new course. Further, the track corrector measures the distance covered from the new point whose coordinates are set on the computer scales.

3. If the VM navigator's indicator fails set the IAR-AE-5 gyro compass selector switch in the "Astro tracker" position and the navigator must check the course by the VJA-ly indicator, the pilots - by the YK-I pilot's indicators.

Bear in mind that the readings of the YK-I and VJA-ly (pointer "A") are correct only in a straight level flight.

4. After landing do not cut out power supply to the autopilot and other gyros till the aircraft is taxied to the parking place.

USE OF INSTRUMENTS WHEN FLYING IN A VARIOUS WEATHER CONDITIONS

When flying in clouds, constantly compare the readings of the flight instruments with those of the auxiliary instruments to detect their failure in time.

If the dynamic line of the left 10-15 Pitot tube fails due to ice-formation or clogging switch-over to the right 10-15 Pitot tube by turning the selector valve clockwise (viewed from the locking before actuating the latch which secures the valve in the correct position). With the valve in this position, all the speed indicators operate from the right 10-15 Pitot tube.

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In the event of the right TL-150 Pitot tube failure (the speed indicators of the co-pilot and the navigator and the ground position indicator being inoperative) do not turn the dynamic system pressure selector valve but be sure that it is properly set for the left TL-150 Pitot tube. In this case the pilot's speed indicator and Machmeter operate.

If the static pressure inlets, which supply the pilot's instruments, fail turn the static pressure selector valve on the port side clockwise and set it in the "Aux." position before actuating the latch which secures the valve in the correct position.

With the static pressure selector valve in the new position, the barometric instruments are supplied from the other pair of the static pressure inlets.

If in this position the instruments do not operate, additionally turn the emergency static pressure selector valve on the starboard side clockwise and set it in the "Emergency" position. With the static pressure selector valve in this position, the barometric instruments are supplied from the static pressure inlets in the wing centre section unpressurised part. After landing, switch off the Pitot tubes heating.

AIR-CE AUTOPILOT

Checking of Autopilot before Flight. The pilot, or the co-pilot must check the autopilot operation before the engines are started for taxiing out. To do this, proceed as follows:

1. Unlock the control surfaces and manually deflect them up to the stops 6-8 times. The controls should move without sticking.
2. Connect an external power supply source and set the "Autopilot heating" switch in the "On" position.

NOTE: Connect the external power supply source and switch on the autopilot heating in accordance with the instructions.

3. Switch on the IT-1000M inverter and having made sure that the "Autopilot Preparation" switch on the autopilot control panel is "Off", energize the autopilot and the compass system.

4. Press the master vertical gyro (MVG) (age button for 30-40 sec. and check the MVG erection by the attitude indicator. Compare the readings of the YT attitude indicator with those of the AIB-2 artificial horizons. Then repeat this check with the auxiliary M.V.C. and again set the vertical gyro selector switch in the "Main M.V.C." position.

5. Synchronize the readings of the ITM-52AM directional gyro with those of the compass system navigator's indicator, and the readings of the YTHK directional gyro indicator with those of the ITM-52AM directional gyro.

6. Having made sure that the "Turn", "Descent-Ascent", and "Bank" controls on the autopilot control panel are in the centre position, and the "Longitudinal stabilization" and "Lateral stabilization" switches are on, set the flight controls in almost neutral position, switch on the "Preparation" switch. Check the automatic centering and the blocking circuits of the servo brake solenoids switching for operation.

The autopilot channels centering is considered accomplished if the green "AP ready" light comes on.

If the light does not come on, switch it on by slightly turning the control wheel.

The blocking circuit of the servo brake solenoids switching is considered correct if, with the "AP ready" warning light off it can be switched off by deflecting the control wheel from the neutral position and with the "AP ON" switch off (with the button pressed), the autopilot is not engaged and the control surfaces can freely move up to the stops.

7. Having made sure that all the autopilot channels are connected (the green "AP ready" warning light should glow continuously

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or blink), switch on the "AP On" switch (press the button). In this case the control surfaces should be fixed, with the "AP On" light out and the blue "Alt. corrector ready" light on.

By applying a force to the flight controls be sure that all the autopilot servos are engaged.

8. Check the "Turn" knob for proper operation, to do this:

- turn the knob first to the right and then to the left from the neutral position to "0", the pedals and control column should not move and the ITM-52AN directional gyro coupling should be cut off (click is heard in the ITM-52AN directional gyro);

- turn the knob right to the 1-st and then to the 2-nd stop; the control wheel should turn to the right and the right pedal should move forward;

- turn the knob left to the 1-st and then to the 2-nd stop; the control wheel and the pedals should move in the opposite direction;

- set the "Turn" knob in neutral position.

NOTE: The knob movement to the 2-nd stop does not cause further deflection of the flight controls due to the limit switches actuation.

9. To check the "Bank" knob for proper operation, turn it to the right (left) with the control wheel deflecting to the right (left). Set the knob in the centre position.

10. Check the "Descent-Ascent" hand wheel for proper operation as follows:

- turn the hand wheel to "Descent", the control column should deflect forward;

- turn the hand wheel to "Ascent", the control wheel should deflect backward;

- set the hand wheel in neutral position.

11. Check the altitude corrector switching; to do this, press the "Altitude corrector" button, with the blue "Alt. corrector

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ready" light on. The light should go out, this indicates that the altitude corrector is on, and the control column should not deflect.

12. To check the "AP" quick disengaging button operation, proceed as follows:

- manually holding the flight controls, press the button on the pilot's control wheel.

The control surfaces must be quickly released from the autopilot control;

- switch off the "Preparation" switch on the control panel and after expiration of 5-10 sec., with the control surfaces in neutral position, engage the autopilot again;

- do not check by the co-pilot's button, as this button is connected to the electric circuit of the servo units emergency disengaging by the cartridges.

13. Switch off the "Preparation" switch on the autopilot control panel and make sure that at the final flight line it is also off.

USE OF AUTOPILOT IN FLIGHT

The autopilot can be engaged during climb, level flight and descent but at an altitude of not less than 1,000 m. and, when flying in clouds, above the clouds with the natural horizon visible.

Engage the autopilot as follows:

1. Be sure:

- that the "Longitudinal stabilization" and "Lateral stabilization" switches on the autopilot control panel are on;
- the "Turn" control knob and "Descent-Ascent" hand wheel are in neutral position, while the "Bank" knob is at "0";
- the warning lights shutters on the control panel are open.

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NOTE: The "Auto.trim." Automatic trim control switch on the autopilot control panel is not connected and may be in any position.

2. Trim the aircraft by the trim tabs in the steady climb condition (or in any other straight flight condition) and set the "Preparation" switch On. The "AP ready" and "Alt. corrector ready" lights should come on.

3. If the green light on the control panel does not come on, switch it on by turning the "Bank" knob on the control panel. If after expiration of 3-4 sec. the green light does not come on, center the "Bank" channel not by the "Bank" centering knob (it should be in almost "0" position) but by slightly deflecting the ailerons within 1-2° simultaneously trimming the aircraft.

The slip indicator ball should be in the centre.

4. With the green "AP ready" light glowing (blinking), switch on the "A.P.On" switch (press the button). The light goes out and the aircraft will continue the flight condition in which it was when engaging the autopilot.

5. By applying a force to the controls be sure that the autopilot servo units are engaged.

WARNING: 1. With the "A.P.ready" light off never engage the autopilot.

2. When engaging the autopilot hold the aircraft controls. In flight, with the autopilot engaged, one of the pilots must constantly check the autopilot for correct operation.

3. In an unsteady flight condition (acceleration, deceleration etc.) never engage the autopilot.

4. If, when engaging the autopilot, the aircraft starts sharply changing the present flight condition, disengage the autopilot by pressing the quick disengaging button on the control wheel.

switch off the "Preparation" switch and check the knobs and switches for proper position on the autopilot control panel, trim the aircraft and engage the autopilot again. If the defect is repeated do not engage the autopilot in flight. If in flight with the autopilot engaged, the aircraft starts changing the established flight condition disengage the autopilot and continue flying with the autopilot disengaged.

5. It is recommended to disengage the autopilot in the same flight condition in which it was engaged (climb, descent or level flight). Otherwise, the load on the control surfaces may result in the aircraft slight jump.

6. If the autopilot is engaged when approaching the required altitude disengage the autopilot, set "Descent-Ascent" and "Bank" controls on the autopilot panel in neutral position, trim the aircraft by the trim wheel in level flight and engage the autopilot again.

7. To switch on the altitude controller in level flight, with the "Altitude corrector ready" light illuminated, push the "Altitude corrector" button. The autopilot automatically maintains the pressure altitude corresponding to the altitude when the altimeter is set to sea level.

WARNING: If the blue "Alt. corrector ready" light is not illuminated, do not push the "Altitude corrector" button.

When controlling the aircraft approach to the autopilot by means of the "Descent-Ascent" knob, the autopilot is automatically switched off.

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8. If necessary, load created by the engaged autopilot control units can be overridden: aileron and elevator control by one pilot's force (about 25 kg. and 40 kg.) and rudder control by two pilots' forces (about 30 kg.).

9. If it is necessary to change the flight speed and altitude duration exceeding 2 hours, disengage the autopilot, trim the aircraft by the trim tabs and engage the autopilot again.

WARNING: Do not deflect the trim tabs with the autopilot engaged.

10. Correct the IIR-52M directional gyro readings after 1-1.5 hours of flying the great circle; introduce the latitude correction after every 2° change in flight.

WARNING: Use of Autopilot Controls.

The aircraft direction and altitude control by the autopilot is accomplished by the pilot or copilot by means of the "Turn" and "Descent-Ascent" controls located on the control panel.

1. When turning the "Turn" knob to the left or to the right the aircraft makes a coordinated turn to the left or to the right respectively.

The turn lasts while the knob is deflected. The aircraft bank angle when making a turn depends on the knob deflection from neutral position. The max. bank angle of the aircraft is 15°, with the knob deflected to the 1-st stop and 20-25°, with the knob deflected to the 2-nd stop.

2. When the aircraft completes the turn hold the knob at the zero position lock till the aircraft takes the horizontal position, and only after this set the knob in neutral position.

3. When turning the "Descent-Ascent" hand wheel backward, the aircraft starts climb or descent. If the altitude corrector has been switched on, it will be switched off.

Max. pitch angle at descent and climb, with the "Descent-Ascent" hand wheel fully turned, is about 17°.

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4. To set the aircraft in level flight, turn the "Descent-Ascent" hand wheel to neutral position.

5. When turning the "Turn" knob right or left and the "Descent-Ascent" hand wheel backward or forward, the aircraft performs the right upward (downward) spiral or left upward (downward) spiral respectively.

NOTE: When turning, climbing or descending, the pilot is allowed to take a hand off the corresponding control, and the aircraft will continue the preset manoeuvre until these controls are set in neutral position.

6. If in flight, with the autopilot engaged, pitch and bank oscillations and jerks of the aircraft occur, disengage the autopilot, switch on the auxiliary master vertical gyro and check it for correct operation by the yr attitude indicator and then engage the autopilot again.

7. Descend the aircraft, with the autopilot engaged to an altitude not below 1,000 m. then disengage the autopilot and change-over to manual control of the aircraft.

NOTE: 1. As a rule, the autopilot is disengaged by the "Preparation" switch on the control panel. Disengage it by pressing the quick disengaging button only in emergency. If the autopilot is disengaged by the quick disengaging button, immediately switch off the "Preparation" switch.

2. Besides, the autopilot can be disengaged by the "A. power" ABC-15 circuit breaker. It is permitted to separately switch off the longitudinal and lateral stabilization by the switches on the autopilot control panel. Bear in mind that repeated switching of the longitudinal stabilization with the autopilot engaged, is prohibited.

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If it is necessary to repeat switching of the longitudinal stabilisation, disengage the autopilot and engage it again as usual.

3. After landing on the airfield, switch off the servos heating. De-energise the autopilot only after the aircraft is taxied to the parking place.

MEASURING THE OUTSIDE AIR TEMPERATURE

The TMB-15 outside air thermometer bulb measures the temperature of retarded air flow, therefore its readings somewhat exceed the true outside air temperature.

To determine the true outside air temperature, introduce into the instrument readings a correction determined by the nomogram given in Supplement No. 1.

If in flight M-number is less than 0.5, to determine the true air temperature, refer to the nomogram Fig. 1, if M-number exceeds 0.5 refer to the nomogram Fig. 2.

Example No. 1 Given: $M = 0.4$,

thermometer reading.... $+7^{\circ}\text{C}$,

Find the point 0.4 on the M-number scale of nomogram No. 1 and draw a line parallel to the base till it crosses the left curve α . Next placing a ruler parallel to the M-number scale determine number N on the lower horizontal scale (equal to 0.981 in this example). Then, applying the ruler to the point 0.4 on the M-number scale and to the point 0.981 on the vertical scale N , find the point of intersection on the line α and mark it. Using the ruler connect the point marked on the line α to the point of temperature indicated by the thermometer on the t_p scale ($+7^{\circ}\text{C}$ in this example) determine on the t_a scale, where the ruler intersects the t_p scale, the true outside air temperature, equal to $+3.6^{\circ}\text{C}$ in this example.

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example No.2 Given: $M = 0.62$,
 thermometer reading -40°C .

Applying the ruler to the points 0.62 (number scale) and -40°C (t_m scale) find the point where the ruler intersects the t_H scale and define the true outside air temperature (-51°C in this example).

9. ELECTRICAL EQUIPMENT

WHEN STARTING THE ENGINES ON THE GROUND

1. The engines starting is performed either from the aircraft or external power supply sources.

2. Prior to starting the engines from the external power supply sources ensure that:

a) both external power supply sources are connected to the aircraft electrical system, the voltage of which does not exceed 28-29 V. The external power supply source having higher power should be connected to the rear receptacle;

b) the batteries are installed in the aircraft. Never start the engines with the aircraft batteries not installed.

c) all the A3C and A3P circuit breakers (except A3C circuit breaker of the IK-1500 inverter) on the radio operator's and navigator's switch panels are in ON position;

d) the external A.C. power supply source is OFF and its receptacle is disconnected from the aircraft electrical system.

3. Prior to starting the engines from the aircraft batteries, ensure that both groups of batteries are connected to the aircraft electrical system and the system voltage is not less than 24 V, following the RA-18 aircraft power supply sources operating instructions furnished with the aircraft.

4. After starting all the engines from the external power supply sources set the "Ext.power-battery" selector switch in

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"Battery" position. In this case the D.C. generators and batteries must be automatically switched ON. After this check, the pilot should say: "Take away the battery cart".

5. During the engines test running separately check the propeller de-icers and windscreen heating system for functioning, primarily switching ON three alternators.

The de-icers operation is examined by checking of the warning lights of the control circuits and readings of the ammeters. The alternator ammeters with the propeller and spinner de-icers ON should indicate 60-70A, and with all the four glass panels heaters ON - 15-18A.

- CAREFUL:**
1. Switch ON the propeller de-icers for one cycle at an ambient air temperature of not higher than $+5^{\circ}\text{C}$. At an ambient air temperature higher than this check the de-icers in flight only.
 2. In summer switch ON the windscreen heating after take-off only.

To prevent the windscreen from misting in winter switch ON the windscreen heating before taxiing for take-off.

In Level Flight

In flight the radio operator must do the following:

a) 25-30 min. after take-off check the distribution of loads on the D.C. generators. When the load is about nominal value (400 A) the difference of ammeters readings should not exceed 40A. If the difference of loads exceeds the value above, adjust the load distribution by means of the remote rheostats installed on the D.C. control panel. When the loads are equalised, the aircraft electrical system voltage should not exceed 28.5 V.

b) periodically check the generators and alternators for correct functioning. When flying, all the C17-12110 starter-generators and three main C17-8 alternators should be ON.

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The generators may be switched OFF during flight if they malfunction only. For example, the aircraft electrical system voltage raises rapidly and several D.C. generators are switched OFF (red warning lights come on) that can be caused by the PH-180 voltage regulator failure.

When this occurs, switch OFF the generator with the faulty voltage regulator, i.e. the overloaded generator. The other generators should be automatically connected to the aircraft electrical system.

c) periodically check the batteries charging current. In case of rapid raise of the charging current (the ammeter off scale indication to the left), switch OFF the batteries;

d) switch ON the standby TIO-8 alternator if any of three main CTO-6 alternators fails;

e) check the HP-1000M and HA-1500 inverters for correct functioning.

CAUTION: In flight, the main HP-1000M inverter should be ON. If the main inverter fails the standby inverter is placed into operation automatically. If necessary, the standby inverter can be switched ON manually by means of a selector switch installed on the A.C. control panel. When the standby inverter is ON the warning light on the A.C. control panel comes on.

f) check the position of the A30 and A31 circuit breakers;

g) 20-30 min. before landing, together with the co-pilot, check the wing and tail unit de-icers for correct functioning. The de-icers operation is checked by flickering of the warning lights of the control circuits and by ammeters; when the wing de-icers are ON, the total readings of all the eight ammeters should increase by 1400-1500A, and, when the tail unit de-icers are ON, the readings should increase by 300-350 A.

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CAUTION: The wing and tail unit de-icers may be switched ON for test when flying outside the icing zone for not more than 8 min.

WHEN STOPPING THE ENGINE

1. After taxiing the aircraft for parking the pilot must do the following:

- a) give a command to switch OFF unnecessary power consumers;
- b) lock the aircraft controls, primarily turning the aircraft controls locking electric actuators circuit breakers ON.

CAUTION: Do not switch OFF the aircraft batteries until the engines are stopped completely.

2. When leaving the aircraft all the crew members must set all the switches, selector switches, circuit breakers and rheostats in "OFF" position.

After the engines are stopped and the passengers leave the aircraft the stewardess must switch OFF all the lights in the passenger cabin.

3. When leaving the aircraft, the flight engineer must ensure that all the power consumers are OFF.

AT NIGHT FLYING

When preparing the aircraft for night flying perform additional checks of all the lighting equipment as instructed below:

- a) Check the instrument and control panels lights; to do this, switch ON the U.V.L., adjust light intensity by means of the trim rheostats, place the lights so that with the control columns in neutral position all the instruments are illuminated;
- b) inspect the cockpit illumination and ensure that the portable lamps, stationary white lights and dome light are in reliable condition;
- c) Check the warning lights except two green lights of the anti-skid control for correct functioning and dim them out by turning the

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light caps to right fully;

d) Check the warning light panels for correct functioning and adjust brightness of their illumination.

After the aircraft traffic controller has issued the clearance to taxi, switch ON the landing, taxi and navigation lights.

The landing lights should continuously glow for not more than 5 minutes.

IN THE EVENT OF ENGINES FAILURE

1. If any of the engines, except the fourth one, fails give a command to the radio operator: "Switch ON standby GPO-3 alternator".

2. In case of two engines failure do as follows:

a) Switch OFF the domestic equipment electrical units.

b) The A.C. power consumers are switched ON depending on certain flight conditions and what engines failed.

- in case of the 1-st and 2-nd engines failure switch-over the standby alternator to the 2-nd engine bus-bar to supply the radio equipment and instruments;

- in case of the 1-st and 3-rd engines failure when flying in icing zones switch-over the standby alternator to the bus-bars of the engines failed in succession to supply the propeller de-icers of the running engines;

- in case of 1-st and 4-th engines failure the de-icers of the 2-nd engine propeller cannot be switched OFF. In this case the aircraft pilot must fly the aircraft to leave the icing zone;

- in case of 2-nd and 3-rd engine failure switch-over the standby alternator to the 2-nd engine bus-bar. When flying in icing zone, switch-over the standby alternator to the 3-rd alternator bus-bar to supply the propeller de-icers of the 2-nd engine until the aircraft leaves the icing zone.

10. RADIO EQUIPMENT

The aircraft radio equipment consists of the following units:

- 1) PUCH-2H radar;
- 2) PCB-5/1230 communication radio with CBB-5 H.F. unit and REC receiver;
- 3) PCB-70 standby communication radio with CBB-70 H.F. unit and VC-8 receiver;
- 4) PCWY-5 V.H.F. command radio (two sets);
- 5) APK-5 ADF with CBY remote control mechanism (two sets);
- 6) KPH-56H marker receiver;
- 7) PB-2 low altitude radio altimeter with G-28 height warning device;
- 8) KPH-4 localizer receiver with I.L.S. amplitude adapter;
- 9) GPH-2 glide-path receiver;
- 10) CHD-7 intercommunication equipment.

The above mentioned radio equipment can be used by the crew members in accordance with their technical data given in table 12.

When operating the radio equipment bear in mind the following:

1. With the propeller, wing and tail unit de-icers energized, when flying in the icing zone, a high interference is generated which makes the H.F. communication difficult or irregular. In this case communicate through the V.H.F. radio sets.

2. Simultaneous operation of both PCB-5/1230 and PCB-70 radio sets is impossible.

NOTE: Simultaneous operation of both PCWY-5 radio sets is possible.

3. Simultaneously with applying power to the V.H.F. radio set No.1 or No.2 connect the antenna, which is common for both V.H.F. radio sets, to the radio set used.

4. If it is necessary to tune or retune the V.H.F. radio sets at the alternate airport (by means of the "H" unit) connect the antenna (by using the selector switch on the co-pilot's electric

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panel in the cockpit) to the radio set tuned. Otherwise, the transmitter of this radio set can fail.

When tuning, refer to the instruction plate installed on the radio set casings.

6. The PCB-5/1230 or PCB-70 radio set antennas changing over from the wire to stub antenna is controlled from the radio operator's control panel. When changing these antennas pay attention to correct and reliable functioning of the relay in the antenna relay box.

6. The M.W. units of the PCB-5 and PCB-70 radio sets can operate with wire antenna only. The interlocking provided in the antenna selection system prevents the possible connection of the CBE-5 M.W. unit of the PCB-5 radio set to the stub antenna. The connection of the CBE-70 M.W. unit of the PCB-70 radio set to the stub antenna are not interlocked but such connection is strictly forbidden.

7. When flying in the vicinity of thunder clouds set the "Operation-ground" selector switch to "Ground" position, preliminarily switching OFF H.F. radio set.

8. In flight the valves may be replaced only in the PCB-5/1230 and PCB-70 radio sets and in the amplifier of the CBE-7 intercommunication system.

9. At flight altitudes exceeding the altitude sensitivity limits of the PB-2 radio altimeter (240-270 m. when operating the radio altimeter on the first band and 2400-2700 m. when operating the radio altimeter on the second band) false actuations of the C-2B height warning device take place when the pointer of PB-46 radio altimeter indicator deflects to the left from the stop. Therefore at flight altitudes exceeding the measurement range switch OFF the PB-2 radio altimeter.

10. When the preset altitude during the aircraft descent is reached, the horn of the C-2B height warning device sounds intermittently and the warning lasts for 4-8 sec.

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To provide the height warning device operation in case of repeated approach for landing, it is necessary that the flight altitude (at repeated approach) should be 40' or 500' m. (for the 1-st and 2-nd bands of the PB-2 radio altimeter respectively) more than the altitude preset by the altitude warning device.

11. When performing steep turns or flying above the mountains the readings of the PB-2 radio altimeter may be unstable and erroneous.

12. To provide operation of the M-900 radio receiver, switch ON the power supply switch on the 4-50 control panel of the localizer and glide-path receivers.

13. The volume control knob labeled "Radio" on the CHV-7 intercommunication control box is used to adjust the signal received from the radio receivers output when performing intercommunication or collective call.

14. If interference affect the operation at any type of communication, change for the other type of communication.

15. With the noise suppressor ON the communication range of the V.H.F. radios somewhat decreases.

16. Switch ON the PICH-2H radar after all the engines are started on the preliminary flight line. It is not recommended to switch ON the PICH-2H radar when flying with bank.

RADIO EQUIPMENT POWER CIRCUIT PROTECTION

The radio equipment A.C. and D.C. circuit breakers and fuses are installed in the circuits supplying the radio equipment power from the aircraft electrical system and directly in the radio equipment.

The radio equipment power circuits are protected by means of AEC and AEP-type circuit breakers and 25-type link fuses.

The location and nominal currents of the fuses are given in Tables 11 and 12.

ENERGIZING THE AIRCRAFT RADIO EQUIPMENT

Before energizing the aircraft radio equipment, the radio operator must ensure that:

a) the voltage of the aircraft D.C. system is equal to 28.5 V and all the circuit breakers of radio equipment are switched ON;

b) to check the radio equipment on the ground, use either the external A.C. power (115 V, 400 c.p.s.) or NO-1500 inverter.

During tests do not connect simultaneously all the radio equipment to the NO-1500 aircraft inverter to prevent it from overload.

PCB-5/1230 COMMUNICATION RADIO SET

The radio set can operate with both wire and stub antennas. The "Wire-Stub" selector switch on the radio operator's control panel is to be set in "Wire" or "Stub" position respectively. The stub antenna installed in the aircraft is used as an emergency antenna in case of wire antenna damage, and, besides this, the stub antenna is necessary at high static interference. To change from the wire to stub antenna set the "Wire-Stub" selector switch in "Stub" position. In this case take into account that the range of communication is decreased as compared with the range of communication when operating with the wire antenna.

The PCB-5/1230 and PCB-70 radio sets have common antennas (wire and stub) and cannot operate simultaneously.

To operate the PCB-5/1230 radio set, turn the "Communic.-command" selector switch on the radio operator's control panel in "Communic." position.

The communication radio set is controlled by the radio operator completely. The pilot and co-pilot can use the radio set for communication with another radio station only after it is tuned by the radio operator to the desired frequency.

The navigator can hear signals of the communication radio only.

To switch ON and use the radio set by the radio operator, do as follows:

a) Ensure that all the controls and tuning knobs of the transmitter are installed in the required position and the appropriate A3C and A3P circuit breakers on the switch panel are in "ON" position.

b) Energize the radio set by turning the "Radio ON" switch on the radio operator's control panel. The radio set can be also switched ON by turning the "Commun.H.F." switch on the co-pilot's control panel.

c) Set the selector switch on the intercommunication control box in "CP" (Communication radio) position.

d) Energize the PHC receiver by means of a selector switch on its front panel and tune the receiver to desired frequency.

e) For voice transmission set the "Voice-Tone" selector switch on the transmitter control panel in the "Tone" position and press the transmitter control button labelled "Radio" installed on the radio control panel under the intercommunication control box (or pedal switch under the radio operator's table).

f) For tone transmission set the "Voice-Tone" selector switch on the transmitter control panel in the "Tone" position and the "Rec.-Trans." in "Trans." position.

The telegraph operation is performed by a key on the control panel.

Monitoring of the emitted signals of the transmitter with the receiver tuning knob set in any position is provided by setting the "Side-tone -Recept.at transmission" selector switch on the radio operator's control panel in the "Side-tone" position. When the selector switch is set in the "Recept.at transmission" position the monitoring of the emitted signals is provided after the receiver is tuned to the transmitter frequency only.

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g) De-energize the radio by turning the "Commun.ON" and "Commun.H.F." switches located on the radio operator's control panel or co-pilot's switch panel respectively. Besides, the PNC receiver may be switched OFF by turning the switch on its front panel.

To use the radio set by the pilots, do as follows:

a) The co-pilot should energize the radio set (if it is not energized by the radio operator) by turning the "Commun.H.F." switch on his switch panel. In this case, the "Pilot operates" warning light on the radio operator's control panel comes on.

b) Set the selector switches on the intercommunication control boxes in the "CP" (commun.radio) position, in this case the receiver operation is heard in the head phones; set the "Intercom.-Radio" selector switch in "Radio" position.

c) To operate for transmission press the "Radio" button on the control wheels.

PCB-70 STANDBY RADIO SET

As well as the PCB-5/I230 radio set the PCB-10 radio set operates with either the wire or stub antennas. Therefore the "Wire-stub" selector switch on the radio operator's control panel must be set in the "Wire" or "Stub" position respectively, and the "Commun.-command" selector switch - in the "Command" position. To change for operation with the stub antenna (if the wire antenna is broken) set the "Wire-stub" selector switch in "Stub" position.

This radio set is remotely controlled by the co-pilot or radio operator.

The radio set is located on the wall to the right of the cockpit door.

As a rule the radio set is tuned on the ground. The radio operator retunes it in flight only in exceptional cases. In this case, set the "Direct-remote" selector switch in the "Direct" position, and after tuning reset the selector switch in "Remote" position.

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The radio set is switched ON from the co-pilot's switch panel. When the radio set is switched ON the "Operation" signal light comes on. The radio operator and co-pilot from their stations can select the channels, tune the receiver, and use the radio set for communication with the other radio stations.

The pilot and navigator can use the radio set for communication with the other radio stations only after the radio operator or co-pilot have energized the radio set, selected the desired channel and tuned the receiver.

To switch ON and use the radio set by the co-pilot and radio operator, do as follows:

- a) Ensure that all controls and tuning knobs of the transmitter are set to the positions which provide its operation.
- b) Energize the transmitter by turning ON the "Command R.F." switch on the co-pilot's switch panel (in this case the "Operation" signal light on the radio operator's control panel comes on).
- c) Set the selector switch on the intercommunication control box in "KP" ("Command radio") position.
- d) Set the channel and mode selector switches on the remote control panel located on the aircraft starboard (between the radio operator and co-pilot's seats) to the appropriate positions.
- e) Energize the YC-8 receiver by turning ON the switch on the co-pilot's or radio operator's receiver control panel and press the control transfer button.
- f) Tune the radio to a desired frequency.
- g) Provide the required volume in the headphones by means of the volume control located on the panel or CH-7 Intercommunication control box.
- h) To provide the voice communication set the mode selector switch in the "TWP" ("Voice") position and press the "Radio" button on the co-pilot's control wheel or the button located under the radio operator's intercommunication control box.

1) To provide telegraph communication (from the radio operator's station) set the mode selector switch on the control panel in the "TII" ("Tone") position. The telegraph operation is provided by a key installed on the table.

To monitor the signals emitted by the PCB-70 transmitter, set the "Side-tone-Recept. at transmission" selector switch in "Side tone" position with the receiver tuning knob in any position or in "Recept. at transmission" when the receiver is tuned to the transmitter frequency.

2) De-energize the transmitter from the co-pilot's switch panel and de-energize the receiver from the receiver control panel (in the co-pilot's or radio operator's station).

To use the PCB-70 radio set by the pilot or navigator, do as follows:

a) Set the selector switches of the pilot's (navigator's) and co-pilot's (radio operator's) intercommunication control boxes in "KP" ("Command radio") position; in this case the VC-8 receiver operation is heard in the headphones.

b) The co-pilot (radio operator) must energize the radio set and tune the receiver to desired frequency.

c) When changing for transmission the pilot presses the "Radio" button on the control wheel and the navigator presses the button located under his intercommunication control box.

V.H.F. COMMAND RADIO SETS

The PCMY-5 command V.H.F. radio sets No.1 and No.2 are controlled (energized and connected to the antenna) by the co-pilot.

The pilot can switch ON any channel on both radio control panels and operate these sets.

The navigator and radio operator can use both command radio sets for communication only after the pilot or co-pilot has switched ON the appropriate channel of the radios.

NOTE: The main radio set for the pilot is the V.H.F. radio set No.1 and that for the co-pilot is the V.H.F. radio set No.2.

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To switch ON and use the command radio sets, the co-pilot must do as follows:

- a) Energize No.1 or No.2 radio sets by means of the "Command V.H.F.-1" or "Command V.H.F.-2" switches.
- b) Connect the antenna to the radio chosen by means of an "Antenna V.H.F. - 1-V.H.F. -2" selector switch (when the selector switch is turned to the left, the antenna is connected to radio set No.1, and, when it is turned right, the antenna is connected to radio set No.2.)
- c) Set the selector switch on the intercommunication control box in "YKP" ("V.H.F.No.1") or "KP" ("V.H.F.No.2") position.
- d) Press the button corresponding to the operating channel on the PCW-5 radio set No.1 or No.2 control panel and listen to the dispatcher operation.
- e) For transmission press the "Radio" button on the control wheel.
- f) To de-energize PCW-5 radio set No.1 or No.2, turn the "Command V.H.F.-1" or "Command V.H.F.-2" switches to the lower position.

To use the V.H.F. command radio sets from the pilot's station, do as follows:

- a) By the pilot's command the co-pilot must energize radio set No.1 or No.2 and connect the antenna.
- b) The pilot turns the selector switch on his intercommunication control box to "KP" ("V.H.F. No.1") or "YKP" ("V.H.F. No.2") position.
- c) Press the button corresponding to the operating channel on the control panel of the PCW-5 radio No.1 or No.2 and listen to the radio station operation.
- d) For transmission press the "Radio" button on the control wheel.

To use the V.H.F. command radio sets from the radio operator's

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and navigator's station set the selector switch on the intercommunication control box to "VHF" (V.H.F. No.1) or "HF" (V.H.F. No.2) position and the "Command V.H.F. 1" or "Command V.H.F.-2" and "Antenna V.H.F.-1 - V.H.F.-2" located in the co-pilot's station to the position corresponding to the radio set chosen for operation.

To change for transmission, press the "Radio" button under the radio operator's or navigator's intercommunication control box.

AUTOMATIC DIRECTION FINDERS

Installed in the aircraft are two APK-5 ADFs with the electrical remote control system (30V). Both ADFs are controlled by the navigator.

The navigator can hear the identification signals of the beacons through the ADF receivers and measure the radio stations relative bearings using the navigator's indicator installed on his instrument panel.

The radio operator can hear the identification signals of the beacons only, (If necessary both the navigator or radio operator can tune the ADFs, to do this, they should raise from their seats.

To switch ON and use the APK-5 ADFs No.1 and No.2, do as follows:

a) Set the selector switch on the intercommunication control box in the position corresponding to the ADF used in this moment ("PK-1" or "PK-2").

b) Energize one or both ADFs by the mode selector switch on the ADF control panel.

c) Tune the ADFs to the required radio stations and after this use them to solve the navigation problems.

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d) To switch OFF the ADFs set the mode selector switch on the control panels in OFF position.

MARKER BEACON RECEIVER

The marker beacon receiver has no controls. It is supplied with power from the glide path receiver. Installed on the pilot's and co-pilot's instrument panels are the marker beacon receiver warning lights, and mounted in the left console is a bell.

RADIO ALTIMETER WITH HEIGHT WARNING DEVICE

The radio altimeter is switched ON and used by the pilot only.

To do this, he must do as follows:

- a) Energize the radio altimeter by a switch located on the radio altimeter indicator.
- b) On the flying line prior to take-off check the radio altimeter for serviceability.
- c) In flight, set the selector switch on the HPP-46 radio altimeter indicator in the position corresponding to the necessary range of altitudes.
- d) De-energize the radio altimeter by a switch on the radio altimeter indicator.

The C-2B height warning device is switched ON and OFF automatically when the PB-2 radio altimeter is switched ON or OFF respectively.

Before using the height warning device set the appropriate selector switch of the altitude preset unit in the position corresponding to the altitude to be warned.

To check the height warning device for serviceability, energize the radio altimeter, set the "Metres & band" selector switch on the altitude preset unit in "K" position and then turn

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it to any other position, for example, "90", in this case the warning system should operate during 4-8 sec. (the light blinks and the horn sounds with a duration of spots.)

Set the "Metres II band" selector switch on the altitude pre-set unit in "K" position and then turn it to any other position, for example, "400". After this the warning system should operate again (the light blinks and the horn sounds with a duration of dashes).

LOCALIZER AND GLIDE-PATH RECEIVERS

The localizer and glide path receivers are switched ON and used by the pilot only. To do this, he must do as follows:

- a) Prior to energizing the receivers ensure that the needles of the HCH-48 I.L.S. indicators are centered accurately, if otherwise, adjust them by the mechanical correctors of the instruments.
- b) Energise the receivers by the switch on the H-50 control panel.
- c) Set the channel selector switch on the control panel to the position corresponding to the operating channel; set the "I.L.S. - CH-50" selector switch in the appropriate position.
- d) When the aircraft is in the ground beacon mode check the localizer and glide path receivers for serviceability by observing the deflection of the needles and appearance of indicating flags on the HCH-48 indicators.
- e) Check the localizer needle zero setting by pressing the "Balance" "Zero check" knob. If the localizer needle does not set in the centre of the black circle, do not release the knob and turn it to the either side until the needle settles in the centre of the black circle. The check above is performed when the system operates in the CH-50 regime.

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CAUTION: Turn the balance knob being pressed when the windows on the HCT-48 indicators are closed with black flags only.

f) De-energize the localizer and glide-path receivers by the switch on the M-30 control panel.

CIV-7 INTERCOMMUNICATION SYSTEM

The aircraft intercommunication system provides intercommunication between the crew members. Besides, by means of the intercommunication control box and some additional selector switches each crew member, except the stewardess can use the radio equipment necessary in flight.

The intercommunication is switched ON by the "I.C.S." switch located on the radio operator's panel.

The "Circuit No. 1 - circuit No. 2" on all the intercommunication control boxes may be in any position.

1. Any crew member, except the steward, can call through intercommunication any other crew member to do this, press the "I.C.S." button on the pilot's or co-pilot's control wheel or the "I.C.S." button under the radio operator's or navigator's intercommunication control box.

When pressing the "I.C.S." button the crew member's throat microphone is connected to the intercommunication amplifier input, and his headphones - to the amplifier output. In this case the received signal of the radio set, for which the selector switch on the intercommunication control box is set, is heard at the volume level lower than that of the intercommunication signal.

The level of the signal supplied from the I.C.S. amplifier output is adjusted by turning the "Common" volume control knob and that of the signal supplied from the receiver output - by turning the "Radio" volume control knob.

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2. To call the pilot or co-pilot, the stewardess should turn the "Pilot-co-pilot" selector switch installed in the galley-pantry in the "Pilot" or "Co-pilot" position (depending on whom the stewardess intends to speak) and press the trigger switch on the telephone receiver.

3. If it is urgent for any crew member, except the stewardess, to communicate with all the other crew members he should press the "Collective call" button on his intercommunication control box, and begin transmission. His voice is heard by all the crew members irrespective of the selector switch position on their intercommunication control boxes. In this case the volume of the radio receiver signal heard by the crew members is lower than that of the intercommunication signal and can be adjusted by means of the "Radio" volume control on the intercommunication control boxes. The volume of the signal supplied from the intercommunication amplifier is adjusted by the volume control labelled "Common".

4. If it is necessary for a crew member to communicate with the other crew member, he should momentarily press the "Collective call" button on his intercommunication control box and call another crew member by voice, having ensured that he is not engaged in communication. Then both crew members should set the selector switches on their intercommunication control boxes in "I.C.S." position and communicate with each other.

DOMESTIC EQUIPMENT

In Flight

1. Before take-off the stewardess may switch on the "Galley is energized" and then "Protection" circuit breakers of the galley/pantry consumers (electric boilers and ovens).

2. If the "Protection" circuit breaker of some consumer is inadvertently switched off, switch it on again and in case of

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repeated inadvertent switching off, switch off the "Switches" circuit breaker and "Protection" circuit breakers and inform the flight engineer of this fault.

3. To energize the galley/pantry electric boilers, be sure that all the "Protection" circuit breakers are on and switch on the "Switches" circuit breakers of the corresponding electric boilers, in this case the green lights above these switches come on. If the light does not come on, switch off the "Switch" circuit breaker and check the electric boiler for proper connection in the socket. Next switch on the "Switch" circuit breaker again and, if the light does not come on, switch off the corresponding "Switch" circuit breakers and "Protection" circuit breakers and inform the flight engineer of it.

4. If the electric boilers normally operate, the water boils in 45-50 min. (if the water had a room temperature, when filling) and in 15 - 20 min. (if the water temperature, when filling, was 45-50°).

Boiling is indicated by steam flow from the steam pipe located on the electric boiler front wall.

After the water starts boiling set the electric boiler switch in the off position; the green light should go out.

5. The stewardess must check the call light signals from the crew and the passengers and answer them.

6. Before landing the stewardess must switch off all the power consumers of the galley/pantry and set the "Galley is energized" switch in the lower position.

AT ALTERNATE AIRPORTS

After the aircraft carrying passengers has landed on an alternate airfield, the stewardess, besides serving the passengers, must:

1. Examine the passenger cabins and domestic compartments

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for cleanliness.

2. Check the toilet rooms for presence of soap and paper napkins:

- for cleanliness of closets, trash containers, wash basins, mirrors, walls and floor;
- for presence of water in tanks and water flow through the washstand hot water and cold water taps.

CAUTION: 1. To prevent the waste tanks overflowing, replenish the water tanks only after the waste tanks are drained.

2. To prevent the water freezing in the tanks of the waste and water supply system at an outside air temperature below zero make sure that the toilet rooms heaters are connected to the external power supply sources.

Supplement No. 5.

CHECK-OUT LIST

to be obligatorily consulted by the flight crew before take-off and landing.

Before taking off to the flight line:

1. The flight engineer, navigator, radio operator, co-pilot and stewardess must inform the pilot of the operations performed by them in accordance with the check-out list.

2. Check to see that the flight documentation is furnished.

3. Check the circuit breakers on the navigator's and radio operator's panels for switching.

4. Check the HT-1000H and HA-1000 inverters for switching.

5. Switch on the AP power supply and the service heaters.

6. Check the hydraulic system pressure gauge readings.

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7. Synchronize the master vertical gyro with the directional gyro.

8. Check the doors and access doors for closing (by checking the warning system signals).

9. Switch on the APX-5 automatic direction finder and check ADF No. 1 tuning to the distant radio beacon and ADF No. 2 tuning to the nearest radio beacon.

10. Switch on the instrument landing system and check the indicator for "0" reading.

11. Switch on the PB-2 radio altimeter.

12. Check the propeller pitch stops for releasing.

13. Fasten the seat belts.

14. Switch on the "No smoking" "Fasten seat belts" light signs.

15. Check that the nose I.C. steering control is on.

16. Unlock the control surfaces.

17. Check the control surfaces operation and the trim tabs setting at "0" position.

18. Switch off the control surfaces locking circuit breakers.

19. Release the parking brake and close the engines starting panel cover.

20. Check the main brakes for reliable operation.

At preliminary flight line:

1. Extend the flaps to the take-off setting position.

2. Check the altimeters for zero reading and compare the barometric pressures.

3. Set the decompression switch in the "Pressurization" position.

4. Open the emergency feathering control panel-cover.

5. Reinstall the I.C. control buttons safety pin into the flight socket.

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SECRET -172-At final flight line:

1. Check the IIR-02 directional gyro, ADF and ILS indicators readings.
2. Set the propeller pitch stops ON and be sure of it.
3. Ask for take-off clearance.

Before landing approach:

1. Look through the approach flight pattern and instruct the crew on the landing approach procedure.
2. Set the compass system for the IIR directional gyro regime of operation (before descending from echeloned altitude).
3. Determine the landing approach stages.
4. Check the AFX-3 automatic direction finders for proper tuning to the distant and nearest radio beacons.
5. Check the ILS indicators for "0" readings.
6. Be sure that the "dead" A.C. steering control is off.
7. Extend the L.S.
8. Cut out air supply to the cabin.

INSTRUCTION FOR USE OF THE CHECK-OUT LIST

The aircraft inspection and preparation before take-off is carried out by each crew member in accordance with the instruction and the check-out lists.

15 minutes before taking-off the crew members occupy their seats in the aircraft and the co-pilot or radio operator reads the check-out list and the crew members inform the pilot of the checks made by them answering the list questions in short "open", "closed", "checked" etc.

The pilot checks the accomplishment of the operations performed.

The check-out list must be kept aboard the aircraft.

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Table 1.

EQUIPMENT OF H-18 84-SEATER AIRCRAFT (Maximum Gross)

Load	Included	Weight, kg.	
		Net	Total
Seats with tables		280	
Oil	In tanks	281.4	
	In oil coolers	43.0	320
	In engines and pipelines	63.6	
Pantry equipment	Containers with dishes and linen - 22 ea	249.7	
	Boxes for second course dishes - 12 ea	10.0	
	Ovens - 2 ea	30.0	309.7
	Boilers - 2 ea	31.0	
	Case	1.0	
Water	In front toilet, I	10.0	
	In front toilet, II	10.0	
	In rear toilet	10.0	30.0
	In air conditioning system	65.0	
Domestic and oxygen equipment (removable)	Carpets (removable)	20.0	
	Literature	20.0	
	Portable oxygen bottles with KHL-21 oxygen regulators	27.0	112
	Oxygen in portable bottles	1.0	
	Oxygen in fixed bottles	2.0	

Table 1.

(Cont'd.)

Equipment	Service equipment	Airsteps Escape chute	12.0 6.0	18
	Auxiliary equipment	Cart for carrying cargo in lower baggage compartments MCI-39 signal flares - 12 lbs	12.5 2.6	15.1
	Equipment without crew			
	87,830			

RATING PARAMETERS AND ENGINE INSTRUMENTS

Parameters	Instrument model	Instrument scale	Ratings							Remarks
			Take-off	Normal	85% normal	70% normal	60% normal	40% normal	Idle	
KFA-5 unit fuel control lever angle, deg.	VHPT-2	0-105	98-105	82-86	70-74	59-63	48-52	33-37	On ground -0 In flight -1 +1	
Hourly consumption, kg./hr. not more than	PMAC		1,040	950	870	790	745		not more than 380	Fuel consumption is given at H=0 and V=0
Fuel pressure before fuel nozzles, kg./cm. ²	3MM-3P	0-100	On ground - not more than						within 1.2-2.2	When planning, fuel pressure before nozzles of aircraft is 1-2 kg./cm. ² for every 1,000 m.
			78	62	52	46	42			

Table 5. (cont'd.)				
Engine rotor r.p.m., %	MI3-2 tach. indi- cator MI3-2 tach. gene- rator.	0-125	95-96 (12,300+1 r.p.m.)	79.5-82.5 (10,400 +200r.p.m.) Engine max. permissible r.p.m. at acceleration test - not more than 1025 (12,200 r.p.m.)
Torque meter oil pressure, kg./cm ²	PM		For take-off and normal ratings (respectively) about 75-80 and about 60-65.	
Engine oil pressure, kg./cm ²	3MK-AP	0-10	At all ratings: on ground - 5-5.5 in flight - not less than 4.	Not less than 4.
Gas temp. behind turbine, °C.	TH-26	100-900	Max. permissible on ground and not more than 120°C in flight.	Max. permis- sible gas temperature behind tur- bine on acceleration - 750°C

Table 5.
(cont'd.)

Engine inlet oil tempera- ture, °C	20% - 30%	From -50 up to +150	Recommended temperature at all ratings on ground and in flight 70-80°C.	Min. +40°C Max. +90°C
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NOTE: Engine ground operation parameters are given at P=760 mm.Hg., outside air temperature = + 15°C. When the engine operates on the ground at 20% normal rating or lower, the engine inlet oil temperature is permitted up to +100°C for not more than 15 min. of continuous operation.

Table 6.

Table for determining W-V

(for aircraft with cruising air speed of 900-700 km./hr)

Wind angle, deg.	Wind speed, km/hr.									
	20	40	60	80	100	120	140	160	180	200
0	360	20	40	60	80	100	120	140	160	180
5	355	20	40	60	80	100	120	139	159	179
10	350	20	39	59	79	98	118	137	157	176
15	345	19	39	58	77	96	115	134	153	172
20	340	19	37	56	75	93	111	130	148	166
25	335	18	36	54	72	89	107	124	141	158
30	330	17	34	52	68	85	101	117	133	149
35	325	16	32	48	64	79	94	109	124	138
40	320	15	30	45	59	73	87	100	114	127
45	315	14	28	41	54	67	79	91	102	114
50	310	13	25	37	48	59	69	80	90	100
55	305	11	22	32	42	52	61	69	77	85
60	300	10	19	28	36	44	51	58	64	70
65	295	8	15	23	29	35	40	46	50	54
70	290	7	13	18	23	27	31	34	36	38
75	285	5	9	13	16	18	20	21	22	22
80	280	3	6	7	9	9	9	8	7	6
85	275	1	2	2	2	0	1	3	7	11
90	270	0	1	3	5	8	12	14	21	27
95	265	2	5	8	12	17	22	26	33	42
100	260	4	8	13	19	26	32	40	48	58
105	255	5	12	18	24	33	42	51	61	72
110	250	7	15	23	32	42	52	62	73	85
115	245	9	18	28	38	49	61	73	87	102
120	240	10	21	32	44	56	69	83	98	115
125	235	12	24	36	49	63	77	91	106	124
130	230	13	27	40	55	69	82	100	118	138
135	225	14	29	44	59	75	91	107	126	147
140	220	15	31	47	63	80	97	114	131	149
145	215	16	33	50	67	85	102	120	138	155
150	210	17	35	53	71	89	107	125	144	161
155	205	18	36	55	73	92	111	130	149	168
160	200	19	38	57	76	95	114	133	152	172
165	195	19	39	58	78	97	117	136	156	176
170	190	20	39	59	79	99	118	138	158	178
175	185	20	40	60	80	100	120	140	160	180
180	180	20	40	60	80	100	120	140	160	180

Head wind (+)

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Table 11.

Fuses installed in aircraft radio equipment power supply circuits

Equipment	Fuses			Location
	Quantity	Type	Nominal current	
1	2	3	4	5
PCB-5/I200 radio	1	A3C-5	5	Radio operator's switch panel
	1	A3P-40	40	Do
	1	CH-2	2	Do
I-PCB-70 radio	1	A3C-5	5	Radio operator's switch panel
	1	A3P-40	40	Do
	1	CH-2	2	Do
PCB-5/I200 and PCB-70 radio sets wire and stub antenna-selector relay.	1	A3C-2	2	Radio operator's switch panel
Radio switching relay (14-1 relay box)	1	A3C-2	2	Radio operator's switch panel
	1	A3C-2	2	Do
PCMA-5 VHF radio No.1	1	A3C-5	5	Radio operator's switch panel
	2	CH-5	5	Do
PCMA-5 VHF radio No.2	1	A3C-5	5	Radio operator's switch panel
	2	CH-5	5	Do
VHF antenna switching relay	1	A3C-5	5	Radio operator's switch panel
A.D.F. No.1	1	A3C-5	5	Navigator's switch panel
	1	CH-2	2	Radio operator's switch panel

1	2	3	4	5
A.B.P. No.2	1	A3C-5	5	Navigator's switch panel
		CH-2	2	Radio operator's switch panel
PH-2 radio altimeter	1	A3C-5	5	Tail junction box
MPH-201 marker receiver	2	HC-2	2	14-T relay box
KPL-2 localizer receiver	1	A3C-5	5	Navigator's switch panel
IPL-2 glide-path receiver	1	A3C-5	5	Navigator's switch panel
Localizer and glide-path receivers	1	A3C-10	10	Navigator's switch panel
CIN-7 intercom. equipment	1	A3C-5	5	Radio operator's switch panel
	2	CH-2	2	
Radar	1	A3C-2	2	Navigator's switch panel
	1	A3C-5	5	Do
		A3C-15	15	Do
	3	CH-5	5	Radio operator's switch panel
	1	CH-15	15	Do

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Table 12.

Fuses used in radio equipment

Radio and radar equipment	Location	Fuse nom. current, A	Circuit
1	2	3	4
PCB-5/1230 communication radio	Power unit	0.5	+1,000 V
	Do	0.5	+350 V
	Do	10	+27 V
	Do	10	+27 V
	PHC receiver	2	115 V, 400c.p.s.
C-2N altitude switch	Switch side wall	2	+27 V
Radar	Unit No.1	5	115 V, 400c.p.s.
		5	+27 V
	Unit No.2	10	+27 V
		0.15	+300 V
		0.15	+50 V
		0.15	+150 V
		5	115 V, 400 c.p.s.
	Unit No.3	0.25	+250 V
		0.25	+150 V
		0.25	-150 V
		2	115 V, 400 c.p.s.
	Unit No.5	5	115 V, 400 c.p.s.
		0.15	+150 V
		0.15	-150 V
	Unit No.6	0.25	+250 V
		0.15	+150 V
		0.15	-150 V
		2	115 V, 400 c.p.s.
	Unit No.8	0.15	+550 V
		0.15	+300 V
		0.5	+250 V

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1	2	3	4
		0.5 0.25 0.25 5	+250 V +150 V -150 V 115 V, 400 c.p.s.
	Unit No.9	10 0.5 0.25 0.25 0.25 0.25	115 V, 400 c.p.s. (unit 2) +250 V (unit 5) +250 V (unit 4) +250 V (unit 4M) 115 V, 400 c.p.s. (unit 4) 115 V, 400 c.p.s. (unit 4 M)
	Unit No.12	2 2 5	+27 V unit 8 cooling +27 V unit 5 cooling +27 V, units 2 and 3 cooling
I-PCB-70 stand-by radio	Power unit Do Do	0.5 0.5 40	+750 V +400 V In dynamotor supply circuit
YC-8 receiver	Power unit Radio operator's receiver panel Do Pilot's receiver panel Do	20 5 2 5 2	In filament and control circuit +27 V 115 V, 400 c.p.s. +27 V 115 V, 400 c.p.s.
PCMY-5 command VHF radio No.1	Rectifier Do Do Do	0.25 0.25 1 1	+300 V -100 V 250 V 250 V

1			
PCNY-5 command VHF radio No.2	Rectifier Do Do Do	0.25 0.25 1 1	+300 V -105 V 250 V 250 V
A.D.F. No.1	Control panel	2 2 2	+27 V 115 V, 400 c.p.s. +27 V +27 V
A.D.F. No.2	Control panel	5 2 2 2	+27 V 115 V, 400 c.p.s. +27 V +27 V
PB-2 radio altimeter	Transceiver front panel	0.25	+ 220 V

Table 13.

USE OF RADIO EQUIPMENT BY CREW MEMBERS

Radio equipment	Crew members				
	Pilot	Co-pilot	Radio operator	Navigator	Stewardess
1	2	3	4	5	6
PCB-5/1230 communication radio set	Transmitter switching ON, two-way telephone communication.	Radio power supply switching ON, transmitter switching ON, two-way telephone communication.	Radio power supply switching ON and tuning radio set, transmitter switching ON, two-way telegraph communication, monitoring of radio operation by indicators and pilot-tone, radio set-to-wire or stub antennas connecting.	Listening radio operation.	Don't use.
PCB-70 standby radio set.	Transmitter switching ON, two-way telephone communication.	Radio power supply switching ON, channels remote selecting, transmitter switching ON, receiver remote tuning, two-way telephone communication.	Tuning, channels remote selecting, transmitter switching ON, receiver remote tuning, two-way telephone and telegraph communication.	Transmitter switching ON, two-way telephone communication.	Don't use.

Table 13.

1	2	3	4	5	6
PCM-5 VHF radio sets No.1 and No.2	Transmitters switching ON and two-way communication by radio sets No.1 and No.2. Channels selection and volume control for radio set No.1.	Radio sets power supply switching ON. Transmitters switching ON and two-way communication by radio sets No.1 and No.2. Channels selection and volume control for radio set No.2.	Transmitters switching ON and two-way communication by radio sets No.1 and No.2.	Transmitters switching ON and two-way communication by radio sets No.1 and No.2.	Can't use
PK-5 automatic direction finders No.1 and No.2.	Radio station relative bearing reading, listening radio stations signals.	Radio station relative bearing reading, listening radio stations signals.	Listening radio stations signals.	Power supply switching ON, radio station relative bearing reading, listening radio stations signals.	
PB-2 radio altimeter with C-2B height warning device.	Power supply switching ON, band selection, warning altitude pre-setting obtaining sound	Sound and light signals of pre-set altitude.	Can't use.	Can't use.	Can't use

1	2	3	4	5	6
	and light signals of pre-set altitude.				
KPS-4H master receiver.	Sound and light signals.	Sound and light signals.	Sound signals.	Sound signals.	
KPS-4 10-caliber and IPR-2 glide path receivers.	Power supply switching ON, channels selection, balance adjustment, indicator using.	Indicator using.	Can't use	Can't use.	
QIV-7 intercommunication system.	Intercommunication with all crew members.	Intercommunication with all crew members.	Power supply switching ON, communication with all crew members except stewardess.	Intercommunication with all crew members except stewardess.	
Radar	Power supply switching ON, mode selection and operation with indicator.	Power supply switching ON, mode selection and operation with indicator.	Can't use.	Mode selection and operation with indicator.	

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